Journal of
Instructional Techniques In Finance
VOLUME 2, NUMBER 1 Spring/Fall2010

DEDICATED TO EFFECTIVENESS IN TEACHING FINANCE

THE FINANCE PROFESSOR TEACHING AN EARLY MORNING CLASS

A VIRTUAL TRADING PROJECT FOR THE DERIVATIVE SECURITIES COURSE

A Method for Teaching the Black-Scholes Option Pricing Model Using Excel

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COVER PHOTO: Balboa Park, San Diego, California

The Finance Professor Teaching an Early Morning Class

Robert Burrus, J. Edward Graham, Clay M. Moffett, Steve Robinson

A broad literature affirms the compromised performance of many people in early-morning settings. How does this affirmation manifest itself in the academic environment in general and the finance classroom in particular? We extend the work of disciplines outside the business school and find a need for the finance instructor to anticipate special needs for the early morning class; students in 8:00 classes, relative to 9:30 classes, underperform, and this underperformance is more pronounced for those with jobs. We provide clear evidence of the better performance of the student in the later class that has no outside employment, and extend these findings to a new set of guidelines for use in early morning classes.

INTRODUCTION

A great many researchers suggest that a number of exogenous factors impact the performance of students across varied disciplines. Common explanatory variables include the students' sex, age and major; among business disciplines, the students' quantitative backgrounds and the *instructor's* gender have been highlighted as predictors of grades in selected classes. Class attendance has also been held out as a predictor of final course grades. Varied authors, though, find conflicting results in their searches for common themes among the successful college or business student. The increasing prevalence of non-traditional class times has also attracted the attention of selected investigators.

In this paper, we consider the direct impact of the often least-desired class time -- 8:00AM -- on student performance, especially among students who, more and more frequently, have jobs outside of school. While varied authors allude to the potential for the broad underperformance of people in many late night or early morning activities, none considers the separable impact of early morning class times and employment upon the business student in general or the introductory finance student in particular.

The 8:00 class is usually the last time slot to "fill up" in a typical registration period. While popular with some students for getting the day started or perhaps for just "getting it over with," the early morning slot is often left with empty seats and groggy students; performance in those classes is certainly compromised, but direct measures of under-performance, and appropriate remedies for those suboptimal outcomes, are not immediately clear. We extend the research in this paper with an examination of the early morning class and the explanatory power that the class time and outside work have in explaining grading outcomes.

We find that introductory finance student performance is compromised in 8:00 time slots. These findings may be unsurprising, but the result bears careful consideration. While students must be warned of the need to maintain particular vigilance in 8:00 classes, faculty members must also seek to keep early morning students engaged. As such, this paper concludes by giving suggestions for improving student focus in early morning classes.

BACKGROUND

Researchers have been pondering the factors that influence student performance for several decades. Among the earliest, Clauretie and Johnson (1975) find that the student closer to graduation, with a higher GPA, who is male and an economics major, performs better than his peers in an introductory economics class; their findings would likely be echoed in an intro finance class. Anderson, Benjamin and Fuss (1994) extend Clauretie and Johnson and underscore the importance of a student's quantitative background in framing success in an introductory econ class. Ballard and Johnson (2004) accept the earlier Anderson, et al findings holding that a "basic understating of algebra" is needed to master initial studies of economics. Schuhmann, McGoldrick and Burrus (2005) note the limited quantitative skills of a great many students, and the need for "quantitative literacy" to frame "economic literacy."

Of special significance for the 8:00 class, Newman-Ford (2008) finds a statistically significant correlation "between … attendance and academic attainment." Newman-Ford's and Ballard and Johnson's (2004) studies are preceded by Durden and Ellis (1995); Durden and Ellis affirm that attendance and the prior study of calculus are positively correlated with better grades in economics. Chan, Shum and Wright (1997) find that attendance is important, but that the relationship with grades is not such that professors should "mandate that students regularly attend" class.

Examining finance student performance alone, Filbeck and Smith (1996) extend Holley and Jenkins (1993) and find that student performance on corporate finance exams is significantly correlated with the four descriptive factors in the Myers- Briggs personality profile. Henebry (1997) and Wilson (2002) underscore the still-evolving nature of research into the factors influencing introductory finance student performance, the former finding improved student performance in shorter, thrice-weekly classes, the latter finding the better performance in less frequent and nighttime classes.

No circulating study we found considered both the impact of the early morning schedule and a student's work responsibilities outside school in describing class outcomes (grades). Many argue that eight o'clock classes help prepare students for the discipline of having a regular job, but do they sacrifice a higher grade as a result? In this paper, we first describe grades as a function of class time and other explanatory variables and then we provide potential remedies for the adverse impact of early morning classes.

DATA

The data used in our study is a unique data set using student academic records, student self reported data, and instructor reported data. The data includes students enrolled in introductory finance under one professor over five semesters

ending in the fall of 2008. All the students were enrolled in morning sections, but some took the 8:00 class and some took the 9:30 section. Because of the brevity of the survey, almost all students enrolled in the classes participated in the survey and fewer than 10% of the surveys were discarded due to inconsistencies or unanswered questions. In all, there were 384 observations in the final data set. Variables collected include:

Academic records:

- GPA (student grade point average at the time of taking the finance course; if necessary, transfer student grade point average are proxied by their graduation grade point average)
- FINANCE (1 if student pursues a finance concentration, 0 otherwise)
- TOTAL (total hours taken at university prior to enrollment in the finance course),
- SEN (1 if the student is a senior, 0 otherwise),
- DOUBLE (1 if the student has two majors, 0 other wise),

Student reported:

- HOURSW (hours worked per week)

Instructor reported:

- CLASS8 (1 if student is enrolled in 8:00 section, 0 otherwise)
- SEM_j (a set of dummy variables indicating the semester that the finance course was taken)
- FINGRADE (average grade points earned in the finance course)

A brief statistical description of the variables utilized is provided in Table 1.

Over sixty-one percent of the students comprising the sample were from 8:00 classes (as there are more 8:00 sections included in the data set). Average hours worked per week was almost 18 hours, with a surprising maximum for one enterprising student of 55 hours. The average GPA was a 3.25, twenty-nine percent of the students were finance majors, and close to half were seniors. Few (less than 10%) were double majors, and almost all majored in business, indicating they had previously been accepted to the business school.

THE HYPOTHESES AND THE MODEL

Using our data set, we test the following hypothesis about early morning classes.

Hypothesis: Students in 8:00 classes (i.e. early morning classes) underperform students in later morning classes.

To test this hypothesis, we use OLS to estimate the following model:

$$FINGRADE_i = \beta_0 + \beta_1(CLASS8_i) + \beta_2(GPA_i) + \beta_3(HOURSW_i) + \beta_4(FINANCE_i) + \beta_5(TOTAL_i) + \beta_6(SEN_i) + \beta_7(DOUBLE_i) + \beta_j(SEM_{ji})$$

Table 1. Descriptive Data.

Descriptive information is given below for the factors employed in the models within this paper. The data were gathered by surveying introductory finance classes at 8:00AM and 9:30AM, over successive semesters between the fall of 2006 and the fall of 2008.

Variable	N	Mean/Fraction of the Sample*	Std. Dev.	Min	Max
CLASS8	236	0.615	NA	0	1
GPA	384	3.259	2.168	1.53	4
HOURSW	384	17.788	13.3	0	55
FINANCE	111	0.289	NA	0	1
TOTAL	384	84.286	17.675	7	161
SEN	178	0.464	NA	0	1
DOUBLE	34	0.089	NA	0	1
FALL06	48	0.125	NA	0	1
SPR07	53	0.138	NA	0	1
FALL07	103	0.268	NA	0	1
SPR08	93	0.242	NA	0	1
FALL08	87	0.227	NA	0	1

*Means are provided for the hours worked per week (HOURSW), the GPA and the total academic hours completed (TOTAL). Fractions or percentages of the total sample of 384 are given for the other factors.

NA = Not Applicable, as with the standard deviation of a dummy variable.

where the variables are defined as before and SEM is a set of semester dummies from Fall 2006 to Fall 2008 with the omitted semester being Spring 2008.

Based on the results of prior research and conjecture, we anticipate positive and significant signs for the coefficient estimates for GPA, FIN, TOTAL, SEN, and DOUBLE; finance students care more about finance courses, and experience at the university should help students to anticipate the needed study time for a good grade. We have no priors concerning hours worked or students with double majors; on the one hand these students may be able to balance their time due to their increased responsibilities, but on the other, they may be stretched too thin to pursue finance studies with excellence.

Since the classes selected were taught by the same instructor, in successive semesters, we do not have to control for instructor. As well, there are no controls for math background since calculus is a prerequisite for gaining admission into the business school. A multitude of other factors (math SAT scores, foreign language proficiency, age, sex, and marital status come to mind) might contribute marginally to this description, but we wished to keep the models as simple as possible, and directed our attention to the working student in the early morning class.

Model results are portrayed in Table 2. Our results, with reference to our hypotheses, are consistent and in line with our expectations. GPA and finance concentrations are positively and significantly related to student grades in introductory finance; each of these last two factors is robust and significant at the 1% level. In addition, hours worked is associated with negative and significant impact upon student grades across the

Table 2. Regression Results[1] .

OLS results with class grade as the dependent variable. Traditional tests for the normality of the residuals (White's test), multicollinearity (VIF) and serial correlation (Durbin-Watson) were conducted with no disconcerting results. Test specification findings are available on request. T-statistics for the significance of the variables are given in brackets along with the Adjusted R^2 and F-test results. Significance at the 10%, 5%, and 1% levels is shown by *, **, and *** respectively.

Variable	1		2		3		4	
CLASS8	-0.1292		-0.12113		-0.1316		-0.12451	
	[-1.66]	*	[-1.54]		[-1.68]	*	[-1.58]	
GPA	0.04266		0.0427		0.04258		0.04265	
	[2.77]	***	[2.77]	***	[2.76]	***	[2.77]	***
HOURSW	-0.01145		-0.01167		-0.01134		-0.0114	
	[-4.52]	***	[-4.56]	***	[-4.44]	***	[-4.51]	***
FINANCE	0.27587		0.28992		0.27154		0.27928	
	[3.73}	***	[3.76]	***	[3.61]	***	[3.74]	***
TOTAL			0.00132					
			[0.65]					
SEN					-0.0229			
					[-0.33]			
DOUBLE							0.04747	
							[0.40]	
FALL06	0.05951		0.06675		0.0577		0.06059	
	[0.48]		[0.54]		[0.47]		[0.49]	
FALL07	-0.20402		-0.20201		-0.20439		-0.20365	
	[-2.18]	**	[-2.15]	**	[-2.18]	**	[-2.17]	**
SPR07	0.1709		0.1671		0.1729		0.172	
	[1.43]		[1.40}		[1.44]	**	[1.44]	
FALL08	-0.14644		-0.14271]		-0.14707		-0.14323	
	[-1.50]		-1.46		[-1.50]		[-1.46]	
Intercept	3.07631		2.95764		3.08816		3.06702	
	[28.81]	***	[13.99]	***	[27.42]	***	[28.03]	***
F-Value	6.84	***	6.12	***	6.08	***	6.09	***

1. "Spr08" was held out to allow the matrices of the other dummy variables to invert, and provide valid coefficient estimates. Results are similar independent of the "hold out" semester chosen.

models. For every hour worked, a student, on average, can expect a 0.012 point reduction in their grade (on a 4-point scale.) For example, a student that works 20 hours would realize an average grade reduction of approximately 0.23 points. For the typical student, this means that working a part-time job entails a modest likelihood that if four courses are being taken, three will exhibit declinations in grades from, for example, a B to a B minus, or an A minus to a B plus; similarly, three B's and one A would likely be changed to four B's (from a semester GPA of 3.25 to around 3.00). Controlling for other factors, and as shown in Table 2, the reader might notice the significant underperformance of the students in the fall of 2007, that semester populated by a distressingly unmotivated coterie.

Concerning our stated hypothesis, the adverse impact of having an 8:00AM class was significant (at the 10% level) in two out of the four regressions with the other two very nearly significant. Thus, there is evidence that taking earlier classes negatively impacts a student's grades. We postulate that the underperformance is attributed to students being tired, experiencing stress from high volumes of traffic and worrying about getting to class on time, and perhaps the impacts of a night on the town. Applying this finding, we now provide some best practices for those instructors teaching 8:00 sections.

SUGGESTED INSTRUCTIONAL RESPONSE: ACTIVE LEARNING (AND OTHER) TECHNIQUES

Managing a classroom is difficult work; this is especially true for the early morning class. Seasoned professors gradually become adept at identifying the psychology at work in these groups, but each class provides its own challenges. There is a general understanding that young people need more sleep to sustain themselves, and many of them remain awake until well after midnight. Thus, when a class meets at 8:00AM, it is reasonable to expect that many of the students are sleep-deprived and many students literally have not yet awakened, having arisen only moments previously.

Having affirmed and measured the underperformance of the working student in the early morning class, what options might be available to the student and the professor in tempering the lower grades and expected "underperformance?"

Finance education has traditionally relied on lectures, supplemented by technical handouts, as the main instructional delivery method. This tradition has motivated students to become *passive* recipients of information given in the traditional lecture format in which the students' only responsibility is to recall what was covered in the lectures and textbook and reveal a familiarity with that information during exams. Pair this information delivery and testing-system is particularly dubious in an early morning setting.

In an attempt to counter the impact of "the straight lecture", Light (1990) shows that students tend to better comprehend and retain complex concepts when they become actively involved in their learning process. In recent years, business schools, and in particular accounting and finance departments, have put in place curriculum changes and employed techniques aimed at increasing student involvement in the learning process. Experiences that involve students and require them to interact as part of their own learning are more likely to maintain student interest and are easily inserted into lectures. Additionally, active learners seem to be more likely to attend class, to become "engaged." When students are asked to participate instead of passively receiving information, they stay focused, audit their own understanding, and are cued to content that has been selected for emphasis. These efforts are vitally important to ameliorate the negative impact of early morning classes.

Active learning also has potential spillover effects in the business world; business executives have voiced concerns that students need to be better-prepared to handle new, unstructured situations, and to search for information from multiple sources. Rather than require more knowledge of certain domain-specific areas (for example, corporate finance and investments in the field of finance), prospective employers have asked that graduates have learned how to learn. The professor might be able to address these perceived shortcomings of the classroom, *and* diminish the underperformance of the early morning and/or working student with the same pedagogical approaches.

We now supply a list of practical active learning (and other) methods for teaching the 8:00 class. In these bits of advice, we assume that the student is the problem and not the professor. (If you suspect that you are the problem, we suggest Starbucks.)

1. BEGIN THE CLASS WITH A BANG. Since students are asleep when they hit their seats, immediately engage them. Tell a story, discuss a current event, use a video clip, and don't immediately move into "chalk and talk."

2. KEEP THE CLASS LIVELY WITH IN-CLASS DISCUSSION AND 'THINK, PAIR, SHARE'. Engage the 8:00 learners with continued in-class exercises where they are forced to speak. Theis (2007) says it best: "If you would like to increase attendance at early morning classes, I recommend incorporating in-class discussion exercises…I typically have students work through a single exercise in small groups … halfway through the class. I let them work for 5 minutes, then we review it as a class. The students get to grapple with a key concept, get moving and talking during an 8:00AM course, and receive a few points for their effort each day…This approach is currently working in a class of 180 as it has previously in classes of approximately 40 students." Johnson and Cooper (1997) report that six professors at Oregon State University, dissatisfied with the lecture method, developed a "feedback lecture." This procedure involved having two, twenty-minute lectures per class meeting, with a professor-posed discussion question after each twenty-minute lecture. Students responded very positively to this approach.

3. KEEP THE STUDENTS GUESSING. Effective instruction mixes things up: boardwork, multimedia, storytelling, discussion, activities, individual assignments, and group work. The more variety built in, the more effective the class is likely to be. Start the class this way, and continue during the class session. If suggestions (1) and (2) are employed, a class session could be easily divided up into 2 mini-lectures beginning with a bang and ending with a discussion.

4. PROVIDE MOTIVATION. Students need to know why a topic is important. To provide better motivation to the 8:00AM finance class, begin the lecture by describing how the contents relate to important business and social problems; tie the class in with the students' experience, interests, and career goals, and do the same thing with each new topic. If all else fails, remind them that they need good grades to get a job (especially in a recession).

5. PROVIDE A CHALLENGE. Will a student be particularly engaged in a class that won't provide a decent challenge?

6. FEED THEM EVERY ONCE IN A WHILE. To get students to attend important club meetings, pizza is provided. These are the same students that attend the 8:00 sections. Once in a while, a box of donut holes can work miracles. Remember that many 8:00 students don't eat breakfast.

7. ADJUST THE CLIMATE. While we realize that this isn't active learning, choose classrooms that are on the east side of your building. If they aren't, make sure the artificial lights are good. If that doesn't work, turn the thermostat down.

8. DON'T LET STUDENTS HIDE. Ask students to sit as close to the front of the class as possible. They'll respond favorably to telling them that the last three rows are off-limits.

SUMMARY, ENCOURAGEMENTS, AND IDEAS FOR LATER RESEARCH

The remarks above affirm several matters with which almost any college professor is familiar. Students have varying degrees of dedication to their studies, are torn between sundry academic and non-academic commitments, and often have full or part time employment that "competes" with their school work. Many are loathe to take an early morning class, either because of their "night-owl" schedules or simply an embedded aversion to early morning duties. It is in this context that most universities, and many professors, confront the early morning student with late-night or daily work schedules. Our findings confirm that these students, on average, can be expected to underperform. The better student, with the higher GPA, who majors in finance and is unemployed or works the lowest possible number of hours, will outperform her contemporary. The working student "forced" into an 8:00AM class is at risk not only of getting a worse grade, but of not meeting the standards of the professional communities in which the student will likely be working after graduation.

How can the business school, the professor and the university respond to this awkward learning environment? The elimination of 8:00AM classes is not practical, nor is a university policy prohibiting students from off-campus employment. Some universities have toyed with reducing or eliminating *some* early morning classes, and selected colleges once prohibited their students from working off campus without university permission. But, the early class and the attraction of many students to off-campus employment (either by necessity or to fund a special trip or a newer car) are here to stay, and the professor is duty-bound to at least try to lessen the impact of these factors.

We suggest, in very general terms, the use of active learning as a counter to traditional pedagogy. Individual faculty in unique settings are of course allowed, and encouraged, to consider and "beta-test" other protocols to better engage the student, increase attendance, and improve finance (and general college) classroom outcomes. In later work, the powers of other factors -- such as sleep habits, selected demographic variables, geography, season and other personal variables (coffee consumption?) -- to explain, or temper, our observations will be examined. It is in that sort of continually re-examined setting that the finance class, or any class, can be improved, and the experiences of the students enhanced.

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Teaching Auction Theory to Finance Students

Jonathan Breazeale and Charles J. Cuny

Auctions are generally taught in economics courses in a discussion of game theory or mechanism design. While the topic is important from a theoretical perspective, it is also crucial to students' understanding of how capital markets work, yet few instructional techniques exist for incorporating auctions into classroom discussions in finance courses. This article summarizes a great exercise/game that allows students to learn about auctions through participation in a series of actual auctions. The exercise is designed for a single class period of eighty to ninety minutes. We have used the game as an introduction to courses in both corporate finance and financial markets and institutions both at the undergraduate and graduate levels. It has been well received by students at numerous universities.

INTRODUCTION TO THE EXERCISE

Prior to the start of class, students are given a handout to assist them in taking notes on the game. This handout can be located at www.jfcr.org/jitfvols.html. This document leads them through the exercise and allows them to focus on participating in the exercise rather than furiously scribbling. The handout identifies the main points of the discussion that follows, and it provides them with the rules of the game and space to answer several key questions of importance under each auction mechanism used.

To introduce and motivate the exercise we emphasize types of financial securities and transactions that are typically sold via auction (or auction-like) mechanisms, offering a very brief introduction into several areas that will receive greater attention later in the course: US government bond issues, share repurchases, (contested) corporate acquisitions, initial public offerings, and most importantly, stock, bond, currency and derivative markets. (Additional examples from economics can be mentioned, such as government contracts, mineral rights, fine art, and eBay.) So many finance examples may seem a little overwhelming for undergraduate students in their first finance class, but it gives them a quick exposure to financial terminology without requiring much detail.

After the importance and relevance of auctions has been established, it is much easier to deliver a quick introduction to auctions and the game itself. In addition to the definitions of *Bid Price* (the price a buyer is willing to pay) and *Ask Price* (the price a seller is willing to accept), it is important for the students to understand that a *Reservation Value* is the maximum value that one ascribes to an asset. The concept of reservation value is very important for the duration of the lesson.

Another (typically) new concept for both undergraduates and graduate students is the variety of auction mechanisms available to sellers when they offer their items for sale. The following list of mechanisms is discussed briefly: (1) Open outcry (oral) vs. Sealed bid (confidential), (2) First-price (the highest bidder pays the highest price bid) vs. Second-price

(the highest bidder pays the second highest price bid), (3) Ascending-bid, or English-style (bids increase until only one bidder is left) vs. Descending-bid, or Dutch-style (start at a high asking price and then decrease; first acceptance ends auction), (4) Single-unit (one item for sale) vs. Multiple-unit (more than one identical items for sale), and (5) One-way (one seller, multiple potential buyers) vs. Two-way (multiple sellers, multiple buyers). This auction game uses the first three of these. To further emphasize that these methods are actually used in the marketplace, we provide one or more example press release(s) from actual financial transactions such as the one below:

CARY, N.C., May 16, 2002 (Reuters) - SpectraSite Holdings Inc. (NasdaqNM:SITE -News) said on Thursday it expects to receive $350 million from private equity firm Welsh, Carson, Anderson & Stowe, and will cut back on its use of towers. The company's shares rose 16 percent. The Cary, North Carolina-based owner and operator of towers that transmit wireless telephone calls said it expects to use up to $340 million of the infusion from Welsh, Carson, which already holds a 22 percent interest in the company, to buy back debt through a "*Modified Dutch Auction*." It said it expects to use the remainder to refinance part of its senior credit facility.

Before the game begins, students are instructed to look for and record the answers to a few important questions:

1. Under various auction mechanisms, what is the optimal bidding strategy?
2. Under various auction mechanisms, who is the winning bidder?
3. Under various auction mechanisms, how much does the seller receive?

At this point, the class is divided into 10 to 20 teams, each of 2 to 4 students. The game is scalable to nearly any class size, but is best with at least 10 teams (bidders). Each team is then provided a score card with private information (related to their own reservation values) for a series of land auctions and a series of gold mine auctions. From the scorecard, students usually deduce that the purpose of the game is to create value for their team by purchasing items at a price below their reservation value. If students ask about their goal in the game, simply telling them to "play as if real money were at stake" normally induces them to attempt profit-maximizing behavior. For the actual Excel file used to generate scorecards with reservation values, visit www.jfcr.org/jitfvols.html.

The spreadsheet includes enough scorecards for 20 teams, plus one master sheet for the instructor. The professor need only open the file and print the document. It is pre-formatted to produce 21 sheets of paper. The instructor's master sheet is produced first, and it contains a summary of the information included on each group's scorecard. For the Series A – "Land" Auctions, each group's reservation value is provided for each parcel of land. For the Series B – "Gold Mine" Auctions, the actual value of mined gold is provided for the instructor. Of course, the value added for each successful bidder is dependent upon both of these pieces of information – along with the price they are willing to pay. The key point to appropriate use of the scorecards is that only the successful bidder should record his/her profit (loss) for each round played.

SERIES A - "LAND" AUCTIONS

Students are told that each team is a firm interested in developing various (independent) parcels of land (properties). Since different firms may have different plans for a given property, reservation values may differ across teams for a given property, as well as differ across properties (just as they would in a market auction). For each property, a team knows only its own reservation value, but knows that value with *certainty*.

Four auction mechanisms are used to sell the properties (with at least one property per mechanism). In each, the professor acts as auctioneer (as well as referee). The first mechanism is open-outcry, ascending-bid (OOAB) [we sometimes refer to this as the "fine art style" auction due to its likely familiarity to students via television or films] where the auctioneer begins at a low price and increases bids (in increments of ten) until there is only one remaining bidder. Students are instructed on how the mechanism works, and (as for all the auctions) they are given a minute or two to quietly discuss bidding strategy amongst their team. They are also asked to use a single bidder for each team. Then the OOAB auction commences for the first property. Once the successful bidder and sales price for the first property is identified, the winning team - and the winning team only - is told to record their "profit" on their scorecard. Of course, all other bidders' profits are zero. A second and third property may also be sold using the same OOAB mechanism. If so, students are invited (as for all the auctions) to spend a few more seconds quietly discussing with their teammates whether to adjust their bidding strategy. A short discussion of results so far can then take place. Each winning team is asked to explain their bidding strategy to the class, and whether it worked out for them. Students generally quickly agree that the optimal strategy is to continue to bid until the team's reservation value is reached.

The second auction mechanism is then introduced. Teams will next bid on properties using a sealed-bid, second-price (SBSP) auction, sometimes called a Vickrey auction. Bidding slips are distributed, and the mechanism is explained. Each team writes down their bid for the next property (as well as their team number) and submits it to the instructor. Each team is allowed only a single bid. The bidding team who submits the highest bid is identified and awarded the property; the price they pay is the *second* highest bid. A tie in the bidding can be broken using a die. The winning bidder records their profit. Up to two more properties may then be sold using the same SBSP mechanism, after allowing a short quiet discussion of bidding strategy among teammates.

Another short discussion of results so far can now take place. Each winning team for an SBSP auction is asked to explain their bidding strategy to the class and whether it worked out for them. Answers certainly vary! The net effect of the two mechanisms used thus far is that they are very similar. For the OOAB auction, the optimal bidding strategy is to *bid up to your reservation value*. The team with the highest reservation value will then win the property, and the price they pay will be (approximately) the second-highest reservation value amongst the bidders (the point at which the second highest valuing bidder will drop out). For the SBSP auction, the optimal bidding strategy is to *bid your reservation value*. The team with the highest reservation value will then win the property, and the price they pay will be the second-highest reservation value. Note

that an initially counterintuitive mechanism (SBSP) results in a very "easy-to-bid" strategy.

The third auction mechanism is then introduced. Teams will bid on properties using a sealed-bid, first-price (SBFP) auction. Each team writes down and submits a single bid for the next property (as well as their team number). The highest bidding team is identified and awarded the property; the price they pay is the highest bid (the price they bid). Again, a tie in the bidding can be broken using a die. The winning bidder records their profit. Up to two more properties may then be sold using the same SBFP mechanism.

Another short discussion can now take place (or be put off until after the fourth auction mechanism). Each winning team for an SBFP auction is asked to explain their bidding strategy to the class and whether it worked out for them. The optimal strategy for what initially seems an intuitive auction mechanism is actually quite complicated. It is (assuming a Nash equilibrium and risk-neutrality) to bid your best estimate of the second-highest reservation value, assuming your reservation value is the highest. In particular, this requires bidding below your reservation value. Students often bid their reservation value; this actually guarantees that they cannot receive a positive profit (no better than not participating)! If bidders bid optimally, this results in the auction price equaling an estimate of the second-highest reservation value.

The fourth (and final) auction mechanism is now introduced. Teams will bid on properties using an open-outcry, descending-bid (OODB) auction. Here, the instructor begins the auction by asking a very high amount for a property, then lowering the asking price by increments of ten until a bidder is identified willing to pay that price. That first bidder is awarded the property at that price bid, and asked to record their profit. Up to two more properties can be auctioned in this manner.

A final discussion on the land auction follows. The SBFP and OODB auctions are essentially the same. Imagine the auctioneer is about to run the OODB auction, but has to step out of the room, so asks the teams to just write down the price at which they would have actually jumped in to bid; this generates the SBFP auction. Overall lessons to be learned include that optimal bidding strategies vary with the mechanism, that some mechanisms (the first two) allow easier implementation of optimal strategies, and that the outcome (assuming optimal bidding) is fairly robust to the mechanism chosen. The outcome is that (approximately) the second-highest reservation value (or an estimate of that value) is paid, even if the seller has no idea of the true value, and the buyer is typically the team with the highest value of the property.

Typical Results - Land Auctions

For the OOAB and SBSP auctions, students are sometimes hesitant until a few rounds have been completed. Some teams win a property because they were confused with the rules or purpose of the exercise. Some winning bidders lose money because they have a poor (sub-optimal) bidding strategy. Some bidders overpay because they really just want to own a piece of land, and are frustrated with not buying anything. It is not unusual for a "winning" team to lose money.

For the SBFP and OODB auctions, winning bidders typically follow one of two strategies. The first strategy is to bid their reservation value because it was identified to be an optimal strategy for the first two auctions. The second strategy, recognizing that a positive profit requires bidding below their reservation value, is to bid only a single bidding increment below their reservation value. Table 1 summarizes results from an actual recent classroom series of land auctions.

Table 1. Typical Land Auction Results (Thousands).

Property	Team	Reservation Value	Price	Profit
Open Outcry - Ascending Bid				
A1	1	880	870	10
A2	8	480	480	0
A3	12	430	440	-10
Sealed Bid - Second Price				
A4	12	960	960	0
A5	10	460	460	0
A6	6	660	700	-40
Sealed Bid - First Price				
A7	1	430	430	0
A8	6	530	530	0
A9	10	770	770	0
Open Outcry - Descending Bid				
A10	5	860	850	10
A11	2	950	940	10
A12	3	500	500	0

SERIES B - "GOLD MINE" AUCTIONS

In the final auctions of the class session, teams bid on newly discovered gold mines. Teams cannot know the exact value of the gold contained in any mine until it has been excavated, so each team has sent their own internal team of geologists to provide them with an *estimate* of the value of the gold each mine contains. The geologists cannot tell the exact value of the gold mine, but they can guarantee that the value of the gold mine lies within a two million dollar range (with a uniform distribution of estimation errors). Students are provided their team's ranges for the various gold mines on their scorecard.

Students participate in a series of up to three SBSP auctions and up to three OOAB auctions. The main difference between the gold mine auctions and the land auctions is that in the gold mine auctions, bidders are *uncertain* of their reservation value. Of course, this is more indicative of the situation where most firms bid on assets - the true value of the asset is unknown at the time of purchase. The actual value of the gold mine is announced right after the conclusion of the bidding, after the winning bidder has been identified.

Afterward, a short discussion (which may be worth repeating for emphasis at the next class meeting) should note that there is information contained in the auction process - other bidders "tip their hand" about their reservation values. This value-relevant information is critical for optimal bidding. Toward the end of the OOAB auction, only two bidders are likely bidding. Why are other teams not bidding? (They may even be laughing or jeering.) They are revealing that their geologists' estimates are lower, probably much lower! Who

typically wins this auction? It is the team whose geologists had the bad luck to have a very high estimate (and whose bidders fail to realize that the majority of geologists were more pessimistic than theirs). Appropriate bidding in the face of this *winner's curse* problem is to incorporate that pessimistic information, lowering one's bid below what it would be otherwise. For these particular gold mine auctions, the optimal bidding strategy is to bid around 100 to 200 (thousand) above the bottom end of their team's estimation range (the exact number depends upon the number of teams).

The discussion is followed by a comparison of cumulative scores over all the auctions, for all the teams. The difficulty of achieving a positive cumulative score is primarily due to the competitive nature of the auction mechanisms.

Typical Results - Gold Mine Auctions

The results of the gold mine auctions can be summarized very easily: *shareholder wealth destruction on a massive scale*. From Table 2, it can be seen that students begin to recognize that they should bid more conservatively but do not realize how conservative they must be to avoid taking massive losses. Add three zeroes to the game, and one can see how a manager could lose their job very quickly if they overbid.

Table 2. Typical Gold Mine Auction Results (Values in Thousands)

Gold Mine	Team	Mine Value	Price	Profit
Open Outcry - Ascending Bid				
B1	1	8590	9900	-1310
B2	4	5780	6800	-1020
B3	8	3980	4600	-620
Sealed Bid - Second Price				
B4	6	7840	8600	-760
B5	2	6170	6600	-430

LEARNING POINTS FOR STUDENTS

Learning Point #1 – *Auctions are Competitive; It's Tough to Make Money*: Very few (if any) of the teams earn a positive cumulative profit. Those who score zero are congratulated; it is a good score.

Learning Point #2 – *Auctions May Generate Valuable Information, Even in Silence*: Near the end of the auctions - particularly the gold mine auctions - the bidding usually consists of two teams battling it out in a series of back-and-forth bids. These teams are ignoring the information contained in the other geologists' estimates! All but two teams are saying nothing (in some cases, there may be jeers or catcalls), yet the high bidder ignores the silence and over-relies on their own private information.

Learning Point #3 – *Winner's Curse*: The winner's curse occurs in auctions with reservation value uncertainty. It states that if Learning Point #2 above is ignored, the high bidder tends to pay too much. This exercise demonstrates this point beautifully.

Learning Point #4 – *Empire Building*: At some point in the game, many teams feel a desire to buy a piece of land or a mine despite the fact that they know they'll probably lose money. Emphasize that CEOs feel the same or even more pressure to *do something*. It is important to be disciplined in bidding.

Learning Point #5 – *Who Ultimately Wins Most Auctions?*: The seller!

LEARNING POINTS FOR INSTRUCTORS

Learning Point #1 – *When to Present this Topic*: On the first day of the semester, the order of business is typically administrative tasks such as reviewing the course syllabus, schedule of classes, the textbook and other required materials, etc. We use this exercise on the second day in which the class meets for the semester. The exercise is used for two reasons: (1) auctions are ultimately how prices are determined for financial assets (the auction results can be extended to lead to a discussion of financial market efficiency), and (2) a game facilitates the class' process through Tuckman's (1965) four-stage model of group dynamics (Forming, Storming, Norming, and Performing). More simply, it gets students talking and interacting with one another; more importantly, it gets them interacting with the instructor.

Learning Point #2 – *Encourage Students to Take Notes*: The auction exercise is preceded by a suggestion from the instructor that each student take diligent notes. Some students internalize this advice while others do not. Students with better notes typically perform better on test questions.

Learning Point #3 - *Testing the Material*: To test the material covered in the auction game, we typically recreate a four or five-bidder auction where the student is given the reservation values. In multiple choice questions, the student is required to identify who would win an auction under the rules of particular mechanism, how much one of the bidders should bid under the rules of particular mechanism, or how much the seller should anticipate the winning bid to be. The winner's curse is generally tested as a short answer question.

MODIFYING THE GAME

The auction game offers a rich set of lessons, and a wealth of material. Depending upon the instructor style and the level of the students, tradeoffs can be made. For example, as few as four land auctions might be run (one auction per mechanism) if the instructor wishes to spend more time discussing the nature of the auctions and optimal bidding strategies. As another example, the game can easily be expanded to fit two hours by including both detailed discussions and multiple auctions under each mechanism.

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Time Value of Money Seminars: Immersion Therapy for Finance Majors

Richard Followill

Finance majors must be able to properly use time-value of money techniques to be academically successful. Recognizing that many of its Finance and Real Estate majors were proceeding beyond their first finance course without an adequate understanding of this crucial skill, the Department of Finance at the University of Northern Iowa instituted a series of voluntary attendance seminars designed to immerse its majors in the mathematics of interest. After four years, the seminars have become an established success, providing most of our majors with the time-value skills necessary to be successful in their academic studies and future careers. This paper tells how these seminars originated and evolved, and offers a roadmap for other finance departments that wish to implement a similar solution for their majors.

In response to recommendations made by our AACSB Accreditation Team, the College of Business Administration at the University of Northern Iowa instituted student learning assessment exit examinations for all of its core courses. For the Finance Department, outcome assessments for our core course in financial management presented strong, but not totally unexpected, evidence that our students were not exiting their first finance course with an adequate grasp of the time-value of money.

The finding that our students could not demonstrate a high degree of competence in the time-value of money after their first exposure to the subject was not surprising. Anyone teaching finance at the university level for any time has likely accumulated a vast amount of anecdotal evidence of this problem; however, we were dismayed by the astonishingly poor results of our exit examinations. Our students could solve the most straightforward problems, but when any level of complexity was introduced to the problems, their results plummeted.

Could the poor results have been attributed to inadequate instruction? Probably not. Results were similar across sections taught by different instructors, and across the different majors. All business majors must take the core financial management course, but for Finance and Real Estate majors, understanding time-value is vital to their future success in both their academic and working careers.

Confronted with compelling evidence that our majors were moving into their higher level courses without an adequate understanding of the mathematics of interest, the Finance Department began to explore possible remedies. Perhaps more time and attention could be devoted to the study of time-value in the core course, but that solution would have to come at the expense of other subjects normally covered. We felt that a better alternative would be to provide our majors with additional instruction outside of the regular curriculum, but we wondered how receptive our students would be to taking classes for which no academic credit could be given.

As Finance Department head at the time, I knew that we had to take some measure to address the problem. I have always believed that students can become highly proficient in this subject if they are provided a coherent mathematical framework, competent instruction in problem solving methods, and numerous problems to solve until they achieve that "aha moment," as one of my students put it, where time value becomes easy, and even the most complex problems are no longer daunting.

Most students majoring in finance have a quantitative bent, and the algebra itself is not especially difficult for them; the difficulty lies in conceptualizing the problem and formulating a correct solution strategy. It takes a measure of time, effort, and dedication to achieve the aha moment. The problem for us was to find a way to direct our students' motivation and effectively channel their efforts into recognizable, tangible results.

For the Finance Department at the University of Northern Iowa, the solution to our problem was to implement a series of seminars designed to immerse our students in the mathematics of interest and the time-value of money. The body of this paper documents our experience in providing these seminars, and examines what has worked and what has not worked. The purpose of this paper is to provide materials and insights to aid other Finance Departments that might wish to replicate and improve upon our experience.

STARTING THE SEMINARS

Since I had been thinking about a project like this for some time, well before our AACSB-directed outcome assessment exams exposed and quantified our student's deficiencies, I of course wanted the seminar series to be successful. Above all else, success required that students voluntarily attend the lectures.

At first, I implored other professors in the department to offer some type of extra credit in their courses to induce our majors to participate in the seminars, but abandoned this idea when a colleague pointed out that it would be inherently unfair to reward some students at the expense of others who had time conflicts or who actually knew the subject already. If our students demanded measurable grade incentives to participate in this project, it would likely fail. We could offer no academic credit, and nothing would show on our students' transcripts to indicate they had received this training. All we could offer our majors was hard work, and the Finance Department's recognition that they had achieved a certain degree of expertise in the time-value of money.

We made this proposition to our majors: We will offer to you a series of late afternoon, two-hour lectures and work sessions designed to immerse you in the mathematics of interest. You will receive no academic credit, and nothing on your transcript will show that you participated. But the seminars are free of cost, and all materials will be provided to you (I wrote a 30-page pamphlet and numerous Excel templates to distribute to

the students). At the end of the sessions you are invited to prove you have achieved mastery of the subject by passing a very difficult exam. The Finance Department will recognize your achievement by prominently displaying your name on a plaque in our display case and on our website.

When I sent the initial email telling our majors about the planned seminars, I wasn't sure what their response would be. Would they give up their afternoons to attend nearly two-hour lectures solely on time value? Would they take a "mastery" exam they knew would be extremely difficult (passing meant they had to tackle five complex questions, making only one or zero rule-breaking mistakes) just to get their name on a plaque?

What happened that first semester was gratifying to say the least. When the sign-up sheet for the seminars grew past 70 students, we had to scramble to find a larger room to accommodate them. We also began to hear from students whom wanted to attend the seminars, but could not do so because of conflicts, and we faced the very real possibility of having to turn some students away for lack of seating.

An email from a graduating senior contained a particularly convincing plea for a second offering. He wrote to tell me that he thought that the "...TVM seminar is a great idea, but like some of the other students I have a conflict with my class schedule and will not be able to attend. This is something I would really like to attend because I can openly admit that I do not have a solid understanding of the TVM concepts. This is scary to me because I am set to graduate in May and I cannot consistently solve the basic TVM problems in my classes without help from notes/textbooks." In response to requests like this, we offered a second seminar series at a different time. An additional 52 students signed up to attend.

Four years have passed since those first sessions were offered in the spring of 2006, and demand has now leveled off to about 60 to 70 students per semester, but virtually all of our majors participate at some point in their academic careers.

THE INSTRUCTION

By agreeing to forfeit a good deal of their free time in exchange for no academic credit, our students told us that they understood the need for time-value skills. But if substantial monetary costs, an expensive textbook for example, had been required of them, student response would have been diminished, and in all likelihood the project would have failed at its very beginning. We had promised that all materials would be provided free of charge, and that required us to produce them. In preparation for our first set of seminars I wrote a text, a problem bank, and a set of excel templates designed to create and solve various time-value problems (some of these materials are shown in the appendix, and are available on this journal's website).

The Primer

The purpose for writing "The Time-Value of Money: A Primer" was to provide students with an introductory text, free of charge, that presented the subject exactly the way I wanted to teach it. While I will gladly make my materials available to anyone wishing to engage in similar project, I would recommend that instructors produce their own. All finance professors should have a command of the subject, but they dramatically differ in their opinions as to how it should be presented to their students. Instruction is likely to be much more effective when the instructor's methods and materials are consistent.

My approach was to present an overview of time-value in only the first two pages of the "Primer," followed by appendices that offer a more detailed presentation of the material. Presented within these two pages are a series of time-value rules that students must adhere to in order to correctly solve the myriad of problems they encounter at the end of the primer.

Calculator or Equations?

All of our students possess business calculators, which have preprogrammed time-value equations, the ability to manipulate interest rates, switch from regular annuities to annuities due, and any number of amazing, but specialized (and confusing) calculations. Yet, I prefer to rely on the time-value equations, and as few versions of them as possible. Why? First, as I explain to my students, the equations provide excellent notation that can be revisited for an explanation of the solution process. Second, students who understand the equations and use them in the solution process are much more likely to arrive at a correct answer than students who do not. Too often I have seen students show their work on examinations by drawing pictures of the calculator buttons they have pushed, almost always to disastrous results.

That said, however, the pre-programmed functions do offer a method to quickly obtain answers correct the penny, and many of our more adept students like to use them. I certainly don't discourage the development of this skill; I do it myself, but I don't "teach the calculator." After they have attained a solid understanding of time-value, most students are highly capable of teaching advanced calculator usage to themselves.

Seminar Timeline

Students are expected to participate in six sessions conducted over a three-week period early in the spring and fall semesters. The first three sessions begin with lectures and end with exercises that are completed in class. Sessions four and five are devoted to working problems as a class with much of session four being devoted to a practice "Mastery Exam." The real Mastery Examination is administered in the final session.

Session 1 The Building-Block Equation

The first session is devoted to what the Primer refers to as the building-block equation:

$$FV = PV(1+i)^n \qquad (1)$$

The equation is derived, and students are introduced to other than annual compounding. The first time-value rule is introduced in this session:

- ***i* and *n* must correspond:** for the building block equation, the period for *i* is given, and *n* defines the number of periods between *PV* and *FV*.

Within the context of this first rule students are taught how to solve for the interest rate, *i*, and the number of periods, *n*.

Numerous problems are worked by the class on a handout that becomes part of their notes.

Admittedly, the material presented in session 1 is very basic, and many of our students are already proficient at this level before we begin. Most students, however, accept the premise that it makes sense to start at the beginning, as if they had no prior knowledge of the subject. And some students have had no prior instruction, as they are premajors who have not yet taken even the core financial management course.

Session 2 Annuities

This session introduces annuities. Particular attention is given to the connection between the open-forms of the annuity equations and their cash-flow timelines. Students are made aware of the equivalence in the open and closed forms of the annuity equations, and the time-value rules relating to annuities are presented.

- ***i* and *n* must correspond:** for annuities the period is defined by the time between payments, and the simple (effective) interest rate, *i*, must fit this time period (since the time period between payments is fixed, *i* may have to be adjusted to fit the time period—see the appendix on manipulating interest rates).

- **Pay attention to the time-line**: The *PV* of an annuity equation consolidates the stream of equal payments into a lump sum amount *one period before* the first payment is made. *FV* of an annuity equation consolidates all payments at *the point in time the last payment is* made.

- **For annuities, *n* is the number of payments—*ALWAYS!***

Perpetuities are introduced in the second session, and an intuitive derivation is presented. Students are advised that the same time-values rules apply to perpetuities with the exception that *n* is no longer relevant.

As in session 1, a problem handout is completed in class. At this point, problems begin to become more complex, with solution procedures requiring several steps. For session 2 problems, however, the simple interest rate given always corresponds to the time between payments, so no interest rate manipulation is required.

Session 3 Manipulating Interest Rates

In this session students learn to manipulate interest rates in order to compare nominal annual interest rates with different compounding periods or to construct an effective rate the fits the time period between annuity payments.

One of the appendices to the two-page primer, entitled "How to Manipulate Interest Rates. And Why," presents the equation:

$$ER = \left(\frac{APR}{\mu} \right)^{\mu} - 1 \qquad (2)$$

where: ER = effective interest rate across a time span
APR = the stated anual interest rate
μ = # compounding periods per year

Using this equation, students can build an effective interest rate across any desired time span. Such manipulation becomes necessary, for example when the time between annuity payments is not the same as the compounding period. Students are made aware of the direct connection between Equation (2) and the building-block equation, Equation (1).

The problems encountered on the Session 3 handout become even more complex, usually requiring students to manipulate the given interest rate before using the annuity equations. Some problems involve multiple annuities with different time spans between payments. A great deal of emphasis is placed on the time-value rule that states:

- **NEVER** add amounts of money unless they are sitting at the same point in time.

At this point students need to begin searching for their own "Aha Moment."

Session 4 Problems, Problems, and More Problems

By now students have received worked problems for the problem set at the end of the primer. At this point we focus on problem-solving techniques; emphasis is placed on the final time-value rule, which is not a mathematical rule, but a vitally important technique.

- **Draw a timeline.** Once you can specify the size and timing of the cash flows, there is no time value problem you cannot solve. A timeline gives you a firm start.

Session 5 The Practice Mastery Exam

After a brief recap of the course, the time-value rules, and the problem solving techniques, students work on a practice mastery exam. While students are advised to take the practice exam seriously, hopefully by preparing for it and taking it under quasi exam circumstances, they are also encouraged to ask for help during the "exam" and even collaborate if necessary. A worked exam is provided at the end of the session.

Session 6 The Moment of Truth

Each student receives one of four equally difficult mastery examinations consisting of five complex problems. The purpose of issuing four different exams is not so much to discourage cheating (which I have never observed in this particular setting), but to guard against the exam becoming too familiar to future participants when it is discussed, as it will be, among current participants. Also, students are invited to enroll in future seminars until they are successful in passing the exam.

A passing grade is achieved when a student makes only one or zero rule-breaking mistakes on the exam. A simple calculator error, unless it is particularly egregious, will be overlooked, but a rule-breaking mistake is a strike, and only one strike is allowed.

Students are invited to view their exams in my office; and many do so because they cannot believe they made even two mistakes. I encourage and welcome these encounters because I know that these students are extremely confident in their newly found abilities. Often, students repeat the seminars just to prove that they can conquer the exam. Occasionally, students who have already passed the exam sit again through the seminars to refresh their knowledge.

OUTCOMES

The time-value seminars have been made available to all of our Finance and Real Estate majors early in each semester since the spring 2006. Since the seminars began, more than 600 of our majors have participated, some more than once. During this same period, the department has seen 499 students graduate. We encourage our majors to take the seminars early in their academic career, and it appears that a large majority of our students avail themselves of this opportunity at least sometime before they graduate.

Not every student who signs up for the seminars completes the entire series. There is no question that these seminars impose upon our students' time, and the need to focus on another course, or a graded assignment, may cause some students to abandon the seminars. Some students complete the series of lectures, but do not take the mastery examination.Thus far, 345 students have attempted the mastery exam, and 160 have completed it making only one or zero rule-breaking mistakes. A pass rate of only 46% might be discouraging if the bar were not set so high. Most students who do not achieve a near perfect exam come pretty close. Perhaps because the exam, like the lectures, is voluntary I have not had a student do poorly on it, and I firmly believe that students who fall short of earning the department's recognition still greatly benefit from their efforts.

A bit of anecdotal evidence provided by our students supports my belief. Shortly after the seminars began, students from UNI and two other Iowa universities attended an all-day interview at AEGON to compete for highly desirable, semester-long real estate internships. This is how a student described his interview: "after a few minutes of just chatting [the interviewer] asked me to solve a time value of money problem. He gave me a present value of a loan, the time frame, and the interest rate, and asked me to compute the payment and remaining balance after a certain point in time. I was extremely confident I could do this until I realized he only used the HP calculator … [In the time the interviewer left] to find a Texas Instrument calculator for me to use, I had begun working the problem out by hand … After I got the correct answer [the interviewer] shook my hand and said, 'congratulations, you are the first person to get the correct answer.' I was his second to last interview of the morning."

"At lunch … I was talking with the others who interviewed in the morning… They had absolutely no clue as to the correct way to solve the problem, and [one student said she] did not even try."

"I do not know who got the internships, but I do know that all of the students from UNI that took the time value of money class correctly answered the interview question, and we all have internships this fall."

While the three University of Northern Iowa students who received AEGON internships that semester did not pass the mastery exam, they obviously did improve their time-value skills in time for the interviews. Their story (with my enthusiastic encouragement) spread throughout the body of Finance and Real Estate majors, and served to promote the newly established seminars.

CONCLUSION

The problems caused by the fact that many students leave their first finance course without achieving an adequate understanding of the mathematics of interest are well known to finance departments everywhere. Undoubtedly, there are many ways to successfully address this problem both within and outside of the finance curriculum. Our extracurricular approach may not be the best method, and we continually look for ways to improve our offering, but our experience has been successful. An intense start-at-the-beginning, equation-based, rules-based, problem-solving immersion experience has worked for students at the University of Northern Iowa, and we offer this narrative to other finance departments as as a guide to one possible solution.

For us there were several key elements to establishing a successful program. Of vital importance is collegial and administrative support. Both my colleagues and dean were very receptive to the idea of establishing the seminars, and helped to shape their implementation. The department's two advisory boards, Finance and Real Estate, also provided advice and support.

No one wants to host a party and have no one show up, so promotion is crucial. We employed fliers and classroom announcements, but most of the effort to promote the seminars took the form of blanket emails to our majors both before and at the beginning of the semester. The emails stressed what most students already knew—that they were deficient in their time value skills, putting them at a disadvantage in their upper level courses and in their future careers. And the email solicitations were spiced up by a retelling of the AEGON interviews experience and a quote by a Real Estate Advisory Board executive who flatly stated, "Whenever we hire someone and find out he or she doesn't understand time-value of money, we know we have made a mistake."

The true reward is knowledge, but recognition is appreciated. Our students have a good midwestern work ethic, and they are competitive. For example, virtually all of our Real Estate majors also major in Finance because they don't want to be at a competitive disadvantage with their fellow students. We appealed to these traits by recognizing our students who truly excelled on the mastery exam, giving them another line item to place on their resumes.

Establishing an extracurricular instructional program in time value for our Finance and Real Estate majors has not only provided tangible results for our students, it has been for me the most rewarding experience of my teaching career. I hope other finance departments capitalize on our experience and take advantage of the materials provided in the appendix to this paper and on the JITF website.

Richard Followill is a finance professor at the University of Northern Iowa.

Five Microsoft Excel Features to Enhance Financial Analysis

Bridget Lyons

The Microsoft Excel program contains hundreds of useful features but it can be daunting to identify appropriate applications. In this paper I demonstrate how five features can enhance financial analysis. The features are applied in a capital budgeting context but could also be utilized in other financial contexts including forecasting, valuation and working capital management. The features examined are: the choose function to create scenarios, data validation to restrict selections, data tables for sensitivity analysis, conditional formatting to highlight key results and scenarios under consideration and concatenation to string together text and formula results.

INTRODUCTION

One of the challenges faced by users of the Microsoft Excel program is that it can be difficult to imagine how some features can be applied to suit a given user's goals. For those working in finance, the program includes hundreds of useful functions and features. In this paper, I demonstrate how to apply five features to enhance an analysis. I have selected a capital budgeting problem to provide context but the features can also be applied in many other types of problems typically considered in corporate finance such as forecasting, valuation and working capital management. The features examined are: the ***choose*** function to create scenarios, ***data validation*** to restrict selections, ***data tables*** for sensitivity analysis, ***conditional formatting*** to highlight key results and scenarios under consideration and ***concatenation*** to string together text and formula results. I begin with a basic solution to a simple capital budgeting problem and then add scenarios and other features.

THE PROBLEM ANALYZED

For purposes of this analysis consider the following problem typical of those found in basic financial management and corporate finance texts. Firm LDC has produced and sold electrical appliances for twenty years. The marketing manager is now proposing an extension of an existing line. The concept is to enter a relatively high margin niche of the lamp market. Information related to the project appears below.

- A consulting company was hired to do a preliminary study of the potential market. The study cost $30,000 and concluded that LDC could sell approximately 40,000 lamps in the first year, 35,000 in the second year, 30,000 in the third year, 20,000 in the fourth year and 10,000 in the fifth year after which the project would be terminated.
- Lamps could be sold for $40 each with prices rising by no more than 3% per year. Raw material costs would be $8 per lamp and might rise by 2.5% per year. Labor and energy costs are estimated at $5 per lamp and are
- expected to rise at 3% per year. Operating working capital of about 10% of revenues would be required.
- The net impact of cannibalization (revenues less all associated costs) of existing product lines would be $250,000 in the first year, 150,000 in the second year, 100,000 in the third year, 75,000 in the fourth year and 50,000 in the fifth year after which the project would be terminated.
- The lamps would be built in an unoccupied part of the firm's manufacturing facilities but operating costs of using this facility are estimated at $18,000 per year.
- The project would require an initial investment of $2,000,000 in equipment that would fall into the 3 years MACRS class.
- The salvage value of the equipment is estimated at $250,000 after dismantling costs.
- The firm's marginal tax rate is 38% and the wacc is 11%. The firm believes the wacc is appropriate to use as the discount rate for this project since the project is of average risk.

I created a basic financial model in Excel (available to users by contacting me) to analyze the problem. To facilitate "what-if" analysis I created a simple model based off key inputs to find net present value, internal rate of return and modified internal rate of return. The basic solution appears in table 1.

FEATURE 1: USE THE CHOOSE FUNCTION TO ADD SCENARIOS

To analyze the problem further I could simply change the inputs to reflect alternative scenarios. This is one technique for scenario analysis. Another technique for scenario analysis is to create "live" scenario options using the choose function. Suppose that management wants to allow for three different scenarios for unit sales and three possible scenarios related to cannibalization of existing product lines. This can be accomplished as follows.

1. Create alternative scenario assumptions.
2. Set up a cell to "control" the scenario selection.
3. In the calculations use the choose function to return the appropriate value.

Note that the choose function arguments are

=choose (index number, value 1, value 2…)

The Choose function returns the selection (from the values entered) that corresponds to the index number. So if the index number is 1; the first of the values is returned. If the index number is 2, the second is returned and so on.

Steps 1 and 2 are depicted below. The box containing the "1" is the cell "controlling" the scenario selection. This is the index number. The choose statement for year 1 units will need to "choose" whichever level of units is indicated by the scenario selected (figure 1)

Table 1. The Basic Solution.

Calculations							
Year		0	1	2	3	4	5
Set up cash flows							
	PP&E	(2,000,000.0)					
	Shipping/installation	0.0					
	Set up cash flows	**(2,000,000.0)**					
Operating cash flows							
	Revenues		1,600,000.0	1,442,000.0	1,273,080.0	874,181.6	450,203.5
	Raw material costs		(320,000.0)	(287,000.0)	(252,150.0)	(172,302.5)	(88,305.0)
	Labor and energy costs		(200,000.0)	(180,250.0)	(159,135.0)	(109,272.7)	(56,275.4)
	Lease expense		(18,000.0)	(18,000.0)	(18,000.0)	(18,000.0)	(18,000.0)
	Depreciation		(666,600.0)	(889,000.0)	(296,200.0)	(148,200.0)	0.0
	Cannibalization - net		(250,000.0)	(150,000.0)	(100,000.0)	(75,000.0)	(50,000.0)
	Taxable income		145,400.0	(82,250.0)	447,595.0	351,406.4	237,623.1
	Taxes		(55,252.0)	31,255.0	(170,086.1)	(133,534.4)	(90,296.8)
	Net income		90,148.0	(50,995.0)	277,508.9	217,872.0	147,326.3
	Depreciation		666,600.0	889,000.0	296,200.0	148,200.0	0.0
	Investment in net working capital	(160,000.0)	15,800.0	16,892.0	39,889.8	42,397.8	45,020.4
	Operating cash flows	**(160,000.0)**	**772,548.0**	**854,897.0**	**613,598.7**	**408,469.8**	**192,346.6**
End of project cash flows							
	Salvage value						250,000.0
	Tax on Salvage value						(95,000.0)
	End of project cash flows						**155,000.0**
	Total project cash flows	**(2,160,000.0)**	**772,548.0**	**854,897.0**	**613,598.7**	**408,469.8**	**347,346.6**
Output							
	Net present value	**153,705.9**					
	Internal rate of return	**14.3%**					
	Modified internal rate of return	**12.5%**					

Figure 1.

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Inputs							
Select a Scenario for unit sales		2					
1	*Base case*		40,000.0	35,000.0	30,000.0	20,000.0	10,000.0
2	*Best case*		55,000.0	45,000.0	40,000.0	40,000.0	40,000.0
3	*Worst case*		25,000.0	30,000.0	30,000.0	20,000.0	10,000.0

Step 3 follows:

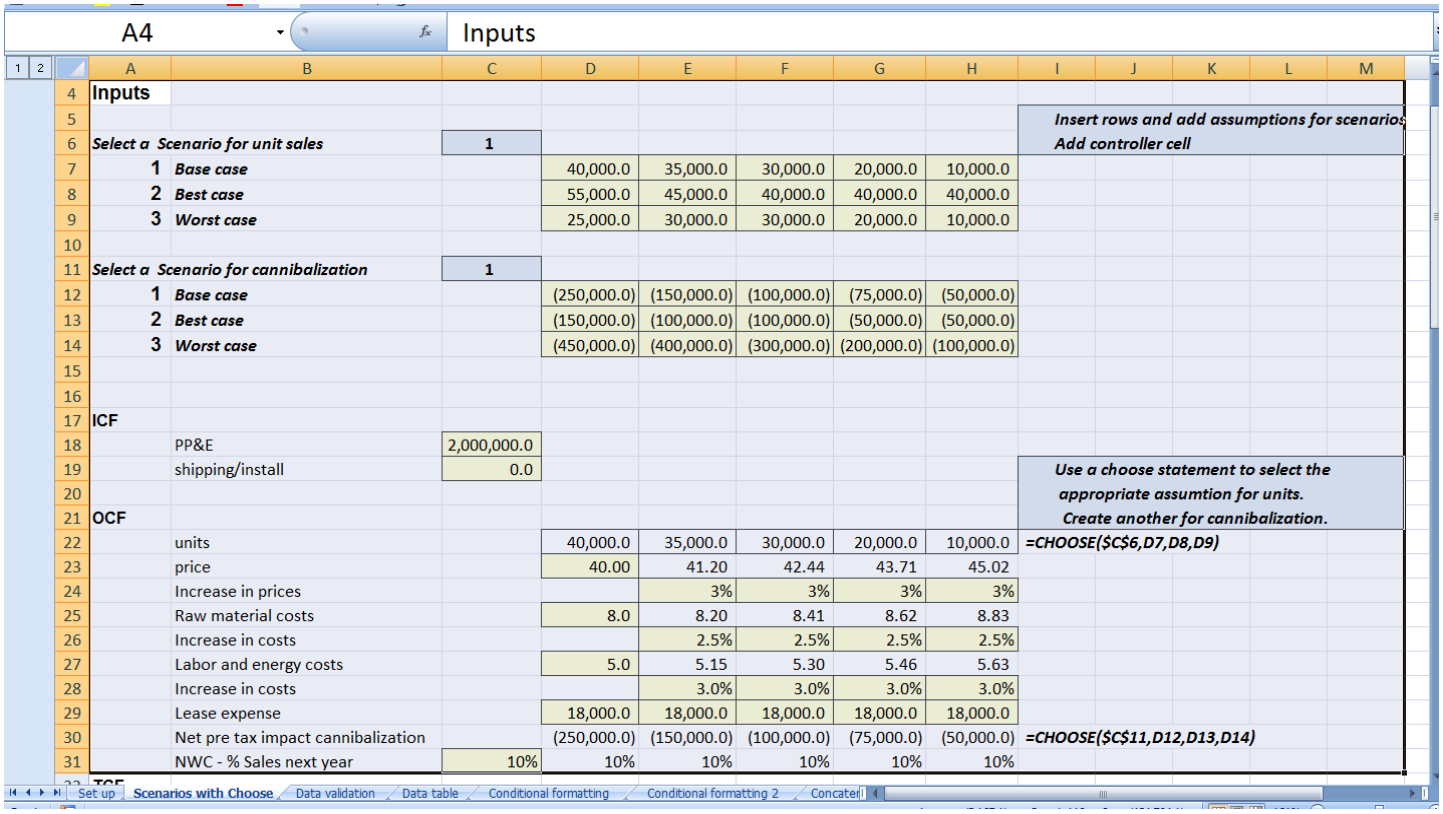
Figure 2.

	Year 1	Year 2	Year 3	Year 4	Year 5		
Units	55,000.0	45,000.0	40,000.0	40,000.0	40,000.0		*=CHOOSE($C$6,D7,D8,D9)*

The controller cell/index number is cell C6 while the possible unit sales for year 1 are 40,000 (contained in cell D7); 55,000 (contained in cell D8) and 25,000 (contained in cell D9). Since the scenario selector cell is set to 1, the first "choice" is returned. If the selection is changed to 2 the result would be 55,000.

In the accompanying excel file there is another scenario created on cannibalization. The screen shot below (figure 3) shows the scenario assumptions and choose statements.

Figure 3.

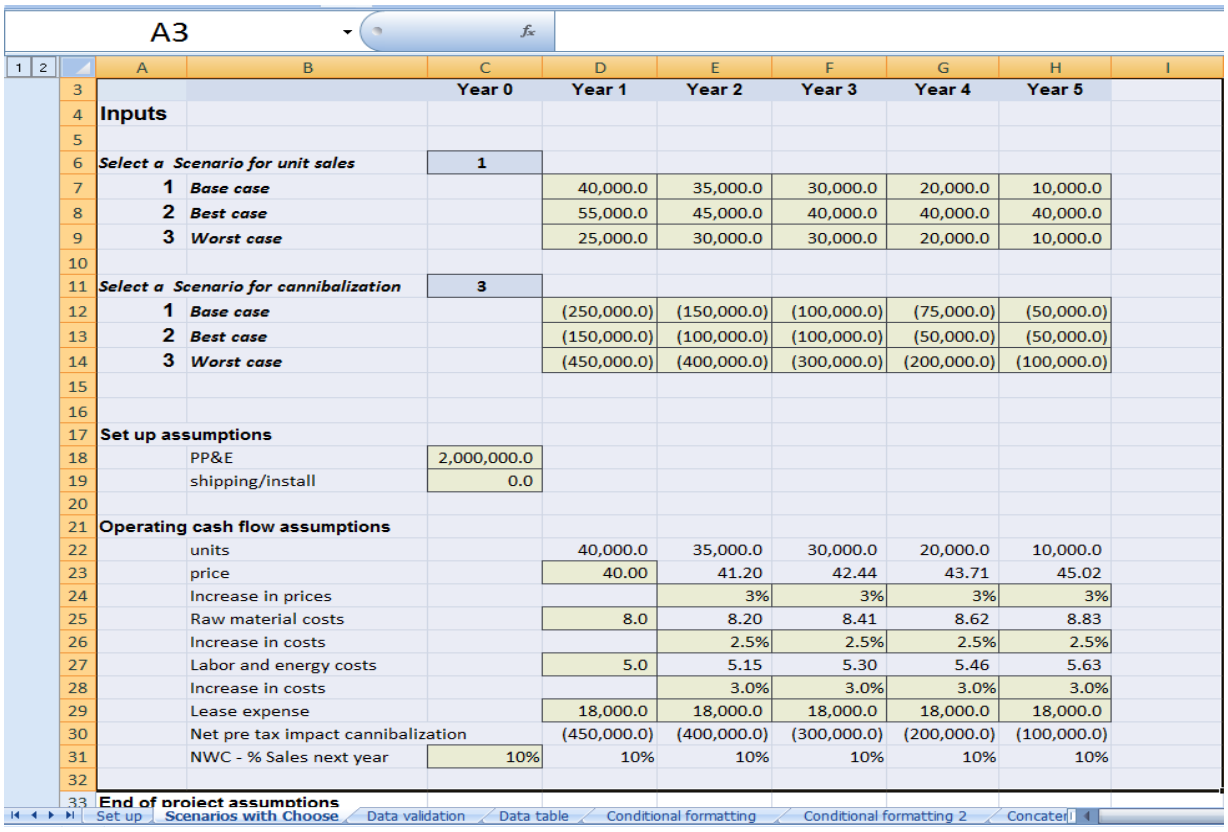


	A	B	C	D	E	F	G	H	I	J	K	L	M
4	Inputs												
5									*Insert rows and add assumptions for scenarios*				
6	*Select a Scenario for unit sales*		1						*Add controller cell*				
7	1	*Base case*		40,000.0	35,000.0	30,000.0	20,000.0	10,000.0					
8	2	*Best case*		55,000.0	45,000.0	40,000.0	40,000.0	40,000.0					
9	3	*Worst case*		25,000.0	30,000.0	30,000.0	20,000.0	10,000.0					
10													
11	*Select a Scenario for cannibalization*		1										
12	1	*Base case*		(250,000.0)	(150,000.0)	(100,000.0)	(75,000.0)	(50,000.0)					
13	2	*Best case*		(150,000.0)	(100,000.0)	(100,000.0)	(50,000.0)	(50,000.0)					
14	3	*Worst case*		(450,000.0)	(400,000.0)	(300,000.0)	(200,000.0)	(100,000.0)					
15													
16													
17	ICF												
18		PP&E	2,000,000.0										
19		shipping/install	0.0						*Use a choose statement to select the*				
20									*appropriate assumtion for units.*				
21	OCF								*Create another for cannibalization.*				
22		units		40,000.0	35,000.0	30,000.0	20,000.0	10,000.0	*=CHOOSE($C$6,D7,D8,D9)*				
23		price		40.00	41.20	42.44	43.71	45.02					
24		Increase in prices			3%	3%	3%	3%					
25		Raw material costs		8.0	8.20	8.41	8.62	8.83					
26		Increase in costs			2.5%	2.5%	2.5%	2.5%					
27		Labor and energy costs		5.0	5.15	5.30	5.46	5.63					
28		Increase in costs			3.0%	3.0%	3.0%	3.0%					
29		Lease expense		18,000.0	18,000.0	18,000.0	18,000.0	18,000.0					
30		Net pre tax impact cannibalization		(250,000.0)	(150,000.0)	(100,000.0)	(75,000.0)	(50,000.0)	*=CHOOSE($C$11,D12,D13,D14)*				
31		NWC - % Sales next year	10%	10%	10%	10%	10%	10%					

Set up | Scenarios with Choose | Data validation | Data table | Conditional formatting | Conditional formatting 2 | Concater

One advantage of this approach to scenarios is that one need not apply a single scenario (i.e. best case) to all assumptions. This is especially useful in financial projections where different geographic areas may experience different revenue growth and cost scenarios. The result follows assuming unit sales are set to the base case and cannibalization is set to the worst case scenario.

Figure 4.



	A	B	C	D	E	F	G	H	I
3			Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	
4	Inputs								
5									
6	*Select a Scenario for unit sales*		1						
7	1	*Base case*		40,000.0	35,000.0	30,000.0	20,000.0	10,000.0	
8	2	*Best case*		55,000.0	45,000.0	40,000.0	40,000.0	40,000.0	
9	3	*Worst case*		25,000.0	30,000.0	30,000.0	20,000.0	10,000.0	
10									
11	*Select a Scenario for cannibalization*		3						
12	1	*Base case*		(250,000.0)	(150,000.0)	(100,000.0)	(75,000.0)	(50,000.0)	
13	2	*Best case*		(150,000.0)	(100,000.0)	(100,000.0)	(50,000.0)	(50,000.0)	
14	3	*Worst case*		(450,000.0)	(400,000.0)	(300,000.0)	(200,000.0)	(100,000.0)	
15									
16									
17	Set up assumptions								
18		PP&E	2,000,000.0						
19		shipping/install	0.0						
20									
21	Operating cash flow assumptions								
22		units		40,000.0	35,000.0	30,000.0	20,000.0	10,000.0	
23		price		40.00	41.20	42.44	43.71	45.02	
24		Increase in prices			3%	3%	3%	3%	
25		Raw material costs		8.0	8.20	8.41	8.62	8.83	
26		Increase in costs			2.5%	2.5%	2.5%	2.5%	
27		Labor and energy costs		5.0	5.15	5.30	5.46	5.63	
28		Increase in costs			3.0%	3.0%	3.0%	3.0%	
29		Lease expense		18,000.0	18,000.0	18,000.0	18,000.0	18,000.0	
30		Net pre tax impact cannibalization		(450,000.0)	(400,000.0)	(300,000.0)	(200,000.0)	(100,000.0)	
31		NWC - % Sales next year	10%	10%	10%	10%	10%	10%	
32									
33	End of project assumptions								

Set up | Scenarios with Choose | Data validation | Data table | Conditional formatting | Conditional formatting 2 | Concater

FEATURE 2: APPLY DATA VALIDATION TO RESTRICT SCENARIO CHOICES

One potential problem with using the choose function is that a user may enter a value other than 1, 2 or 3 into the scenario "controller" cell. If this occurs, an error message is returned because in our example there are only three choices. To guard against this, use data validation to restrict choices to a preset selection.The results appear in figure 5.. Note that when a user puts the cursor in the scenario "controller" cell the scenario alternatives pop up as shown below. Directions follow.

Figure 5.

	A	B	C	D	E	F	G	H
1	**Data Validation**						© Bridget Lyons 2009	
2	**LDC Manufacturing**							
3			Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
4	**Inputs**							
5								
6	*Select a Scenario for unit sales*		1					
7	1	*Base case*		40,000.0	35,000.0	30,000.0	20,000.0	10,000.0
8	2	*Best case*		55,000.0	45,000.0	40,000.0	40,000.0	40,000.0
9	3	*Worst case*		25,000.0	30,000.0	30,000.0	20,000.0	10,000.0
10								
11	*Select a Scenario for cannibalization*		1					
12	1	*Base case*		(250,000.0)	(150,000.0)	(100,000.0)	(75,000.0)	(50,000.0)
13	2	*Best case*		(150,000.0)	(100,000.0)	(100,000.0)	(50,000.0)	(50,000.0)
14	3	*Worst case*		(450,000.0)	(400,000.0)	(300,000.0)	(200,000.0)	(100,000.0)
15								
16								
17	ICF							
18		PP&E	2,000,000.0					

Select a scenario.
1= Base
2 = Best
3 = Worst

Set up | Scenarios with Choose | Data validation | Data table | Conditional formatting | Conditional formatting 2 | Concater

To use data validation you must first have a list of choices to enter. In this case the choices are 1, 2, 3 and are entered in cells A7, A8 and A9. The box contains instructions related to the choices but we will need numbers as the choices since the scenario is driven by a choose statement which requires an index value that is a number.

The steps to use data validation follow.

1. Select data validation from the data menu under data tools
2. On the settings tab, under "Allow" select list to allow a list of scenarios. In the "Source" box enter the cells where the possible scenarios are listed. Here this is in cells A7, A8, A9.
3. If you choose you can also enter an input message and/or an error message on the following tabs in the dialog box. The input message appears when a user clicks in the cell containing data validation. The purpose is to provide instruction. In this example the input message is "Select a scenario. 1=Base; 2= Best; 3= Worst". You can also add an error message that will display if a user enters a value directly rather than selecting from the choices provided.

The results appear below. Data validation is especially useful when a spreadsheet is created by one individual but used by others who may be less skilled in financial modeling.

Figure 6.

	A	B	C	D	E	F	G	H
1	**Data Validation**							
2	**LDC Manufacturing**							
3			Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
4	**Inputs**							
5								
6	*Select a Scenario for unit sales*		1					
7	1	*Base case*				30,000.0	20,000.0	10,000.0
8	2	*Best case*				40,000.0	40,000.0	40,000.0
9	3	*Worst case*				30,000.0	20,000.0	10,000.0
10								
11	*Select a Scenario for cannibalization*		1					
12	1	*Base case*				00,000.0)	(75,000.0)	(50,000.0)
13	2	*Best case*				00,000.0)	(50,000.0)	(50,000.0)
14	3	*Worst case*				00,000.0)	(200,000.0)	(100,000.0)
15								
16								
17	ICF							
18		PP&E	2,000,000.0					

Data Validation
Settings | Input Message | Error Alert
Validation criteria
Allow: List
Data: between
Source: =$A$7:$A$9
Ignore blank
In-cell dropdown
Apply these changes to all other cells with the same settings
Clear All | OK | Cancel

Set up | Scenarios with Choose | Data validation | Data table | Conditional formatting | Conditional formatting 2 | Concater

FEATURE 3: CREATE A DATA TABLE TO PERFORM SENSITIVITY ANALYSIS

Data tables allow a user to display the results of a formula under different input assumptions. Data tables can be constructed to allow for one or two inputs to be altered. This feature will be demonstrated by creating a data table for net present value under different assumptions regarding the operating working capital required (as a percent of sales) and the weighted average cost of capital, assumed here to be an appropriate discount rate. The end result appears directly below followed by the steps to create the table. Note that for high WACCs and high assumptions regarding OWC as a percent of sales, NPV is lower. For example, if OWC is 12% of sales and the WACC is 13% then the project NPV is $46,542.

Figure 7.

	A	B	C	D	E	F
85						
86	***Add a data table on OWC % of sales and WACC***					
87						
88						
89		**NPV for different assumptions on OWC as % of Sales and WACC**				
90			***Operating Working Capital - % Sales***			
91						
92		153,705.9	**12%**	**11%**	**10%**	**9%**
93		**13%**	46,542.4	52,012.8	57,483.3	62,953.7
94		**12%**	94,416.2	99,570.5	104,724.9	109,879.2
95	***WACC***	**11%**	144,057.4	148,881.6	153,705.9	158,530.2
96		**10%**	195,555.1	200,034.5	204,513.9	208,993.3
97		**9%**	249,004.2	253,123.0	257,241.9	261,360.8
98						
99						
100						

Set up | Scenarios with Choose | Data validation | **Data table** | Conditional formatting | Conditional formatting 2 | Concate

Steps to create a data table:

1. Select an area for the table and use a cell reference to the formula to analyze. Here in cell B92 the formula is = C82 since the NPV calculation is performed in C82. Data tables must be created based on a formula since the function operates by recalculating the formula with different input assumptions. The reference to the formula must be in the top left of the table.

2. Type in the range of values for the inputs you want to analyze. In this example OWC as a percent of sales ranges from 12% down to 9% in 1% increments. WACC ranges from 13% to 9%. These values are just typed in. You must type the values in immediately right and below the reference to the formula leaving no blank cells. You CANNOT use a reference to the original input assumption in the border of your table or the table does not calculate properly. At this point the table should appear as follows:

Figure 8.

	A	B	C	D	E	F
85						
86	***Add a data table on OWC % of sales and WACC***					
87						
88						
89		**NPV for different assumptions on OWC as % of Sales and WACC**				
90			***Operating Working Capital - % Sales***			
91						
92		153,705.9	**12%**	**11%**	**10%**	**9%**
93		**13%**				
94		**12%**				
95	***WACC***	**11%**				
96		**10%**				
97		**9%**				
98						
99						
100						

Set up | Scenarios with Choose | Data validation | **Data table** | Conditional formatting | Conditional formatting 2 | Concate

3. Now select the entire table from cell B92 through F97. Once selected go into the data menu. Under data tools, select "what if" analysis and then select data table. A dialog box will appear prompting you for a row input cell and a column input cell. For row input cell enter the cell that contains the original assumption on OWC as a percent of sales. In this file that cell is C31. For column input cell, enter the cell containing the original assumption for WACC, here cell C35. Then hit enter and your data table should be complete and should appear as at the beginning of this section.

Data table hints:

- Once a data table has been created, you may change the input assumptions on the borders and the results will update. You may not remove a row or column in the table once created. If you want to eliminate a row or column delete the interior of the table first.
- Inputs used in the data table must be pulled from the tab on which the data table is constructed (you cannot pull from another sheet in the workbook).
- As mentioned above, the borders should be typed in and SHOULD NOT use a cell reference to the original input as this leads to inaccurate results.
- If you are working in a model and the data tables do not seem to be functioning, check that calculations are set to automatic and not automatic except tables.

FEATURE 4: APPLY CONDITIONAL FORMATTING TO HIGHLIGHT KEY RESULTS OR SCENARIOS SELECTED

Conditional Formatting with Data Tables

Data tables are a helpful visual for displaying the results of a formula under a variety of assumptions. Conditional formatting can be used in conjunction with a data table to highlight key results.

In this example, conditional formatting will be applied to make it clear what WACC and OWC assumptions are required to yield a net present value of at least $100,000.

When complete the data table will appear as follows. Note that only values with NPV's exceeding $100,000 appear. That is because the formatting applied is to "white out" values less than $100,000. However, this is just one example. Conditional formatting allows for a variety of fonts, colors, borders and fills.

Figure 9.

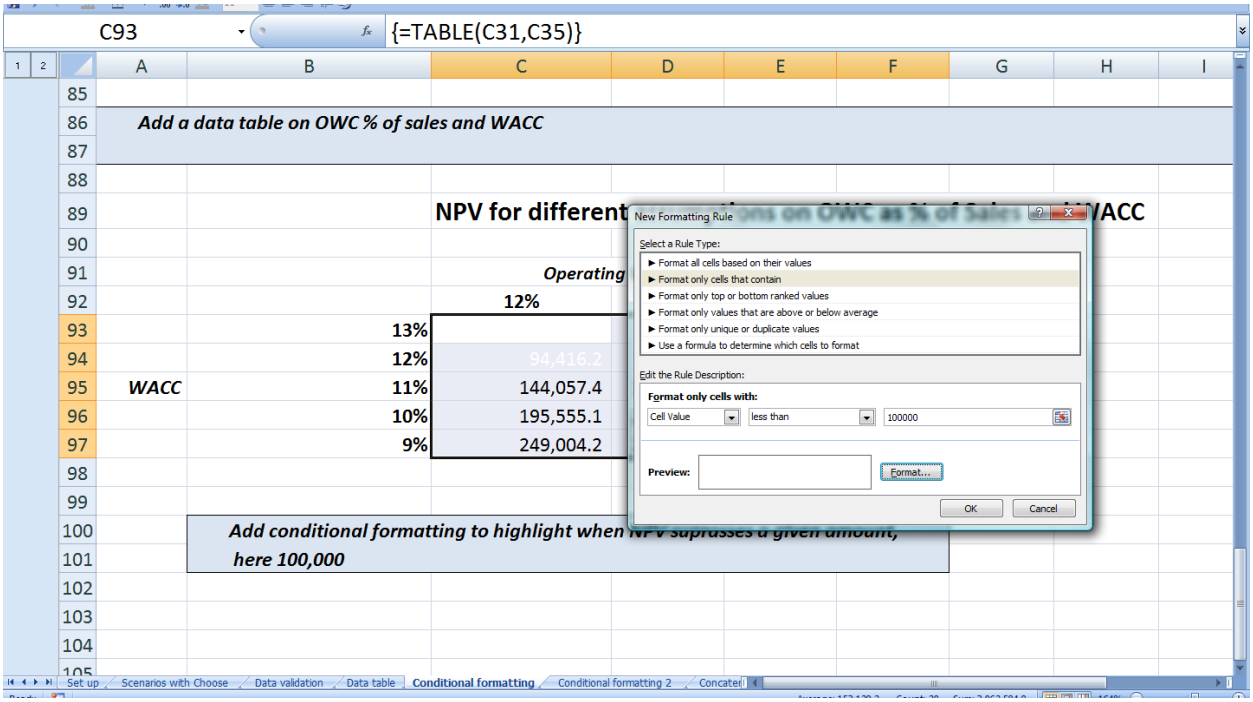
	A	B	C	D	E	F	G	H	I
85									
86	*Add a data table on OWC % of sales and WACC*								
87									
88									
89		NPV for different assumptions on OWC as % of Sales and WACC							
90									
91			*Operating Working Capital - % Sales*						
92			12%	11%	10%	9%			
93		13%							
94		12%			104,724.9	109,879.2			
95	*WACC*	11%	144,057.4	148,881.6	153,705.9	158,530.2			
96		10%	195,555.1	200,034.5	204,513.9	208,993.3			
97		9%	249,004.2	253,123.0	257,241.9	261,360.8			
98									
99									
100		*Add conditional formatting to highlight when NPV suprasses a given amount,*							
101		*here 100,000*							
102									

Steps to apply conditional formatting:

1. Select the cells to apply formatting to. In this example select only the interior of the table not the borders.
2. On the home tab, under styles, select conditional formatting. Then select "New rule". For the rule type select "Format only cells that contain".

Assume we want to format cell values below 100,000 in white font. To achieve this under "Format only cells with" in the first box select "cell value". In the middle box select "less than". Then in the right most box type 100000. Then select a format; here white font but note that there are many color, font, border and fill options. Click OK. The results should appear as above.

Figure 10.

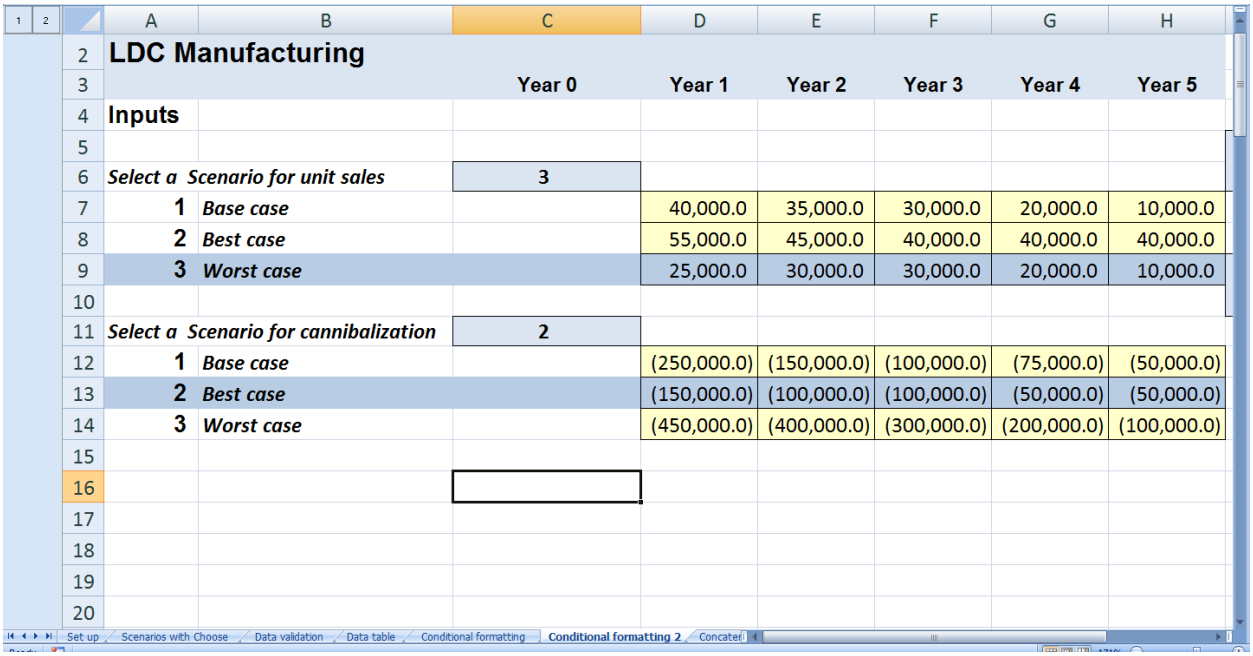


Conditional Formatting with Scenarios

Next conditional formatting is used to highlight the scenario selected. Recall in the first section scenarios were created using the choose function.

Here, conditional formatting is added to highlight which scenario is in use. In the screen shot below scenario 3 has been selected for unit sales and scenario 2 for cannibalization. The use of conditional formatting makes this very clear by applying a blue fill to the scenario in use. The results appear below.

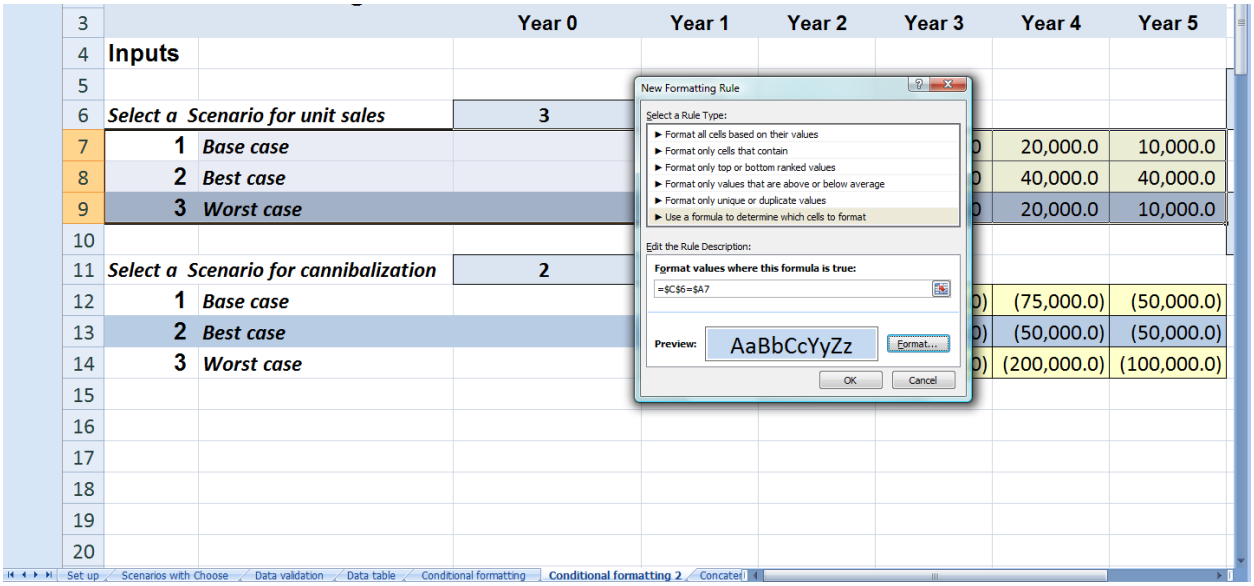
Figure 11.



The steps to apply conditional formatting to scenarios as displayed above follow.

1. Select the area to be formatted. In this example, cells A7 through H9 for the unit sales scenario. (Later cells A12 through H14 for the cannibalization scenario).
2. On the home tab, under styles, select conditional formatting. Then select "New rule". Select "Use a formula to determine which cells to format".
3. Here the formula is "=$C$6 = $A7". This allows us to format the row of the scenario matching the scenario in the controller cell. Be careful to only lock the column reference, A, and not the row since this rule will apply to rows 8 and 9 as well.
4. For the format select a fill, here blue. For "applies to" fill in the range to apply to here "=$A$7:$H$9". Then ok.

Figure 12.



FEATURE 5: CONCATENATION TO STRING TOGETHER TEXT AND FORMULA RESULTS

Using the ampersand operator or the concatenation function in Excel enables the user to string together text and formula results. This can be useful in summarizing results and is especially useful when the results should be updated to reflect changes in assumptions, data, scenarios etc. In this example the NPV and IRR are summarized in a statement at the bottom of the analysis but this could also appear on a summary page.

The results follow. This is based on both scenarios set to the base case.

The net present value is $153,706 and the internal rate of return is 14.27%.

If the user switches both scenarios to scenario 2 the results automatically update to:

The net present value is $1,805,549 and the internal rate of return is 40.67%.

The steps to return this information are to include any text in quotes and to connect text and formula results with the "&" operator or by using the concatenate function.

The following formula yields the results below (this assumes the formula for NPV is in cell C82 and the formula for IRR is in cell C83).

Formula:

="The net present value is "&C82&" and the internal rate of return is "&C83

Result:

The net present value is 1805549.38574101 and the internal rate of return is 0.406744551557681

The steps to return this information are to include any text in quotes and to connect text and formula results with the "&" operator (used here) or by using the concatenate function (detailed below). However the results do not apply the formatting in the original cell and are not appealing. To avoid this, wrap the cell reference in a text function and specify the formatting desired.

For example, the following formula:

="The net present value is "&TEXT(C82,"$#,000")&" and the internal rate of return is "&TEXT(C83,"0.00%")&"."

yields these results:

The net present value is $1,805,549 and the internal rate of return is 40.67%.

Be sure to leave a blank space within the text if that is desired.

While it is straightforward to use concatenation, it takes a bit of practice to get comfortable with the text function to specify desired format. The following tips should facilitate use of the text function for formatting.

- The text format must be entered in quotes
- # means to show a number only if there is a number (other than zero)
- 0 means show a number and if there is no number show zero
- Use a comma in the text format if you want a "thousands" separator
- Use "$" or "%" if you want that displayed

For example:

If the number is	*To display as*	*Set up as*
1234.555667	$1,234.6	=TEXT(C113,"$#,000.0")
234.5556667	$0,234.56	=TEXT(C114,"$0,000.00")
1234.555667	1234.56	=TEXT(C115,"#000.00")
1234.555667	1235	=TEXT(C116,"#000")
23.4567%	23.46%	TEXT(C117,"0.00%")
0.56%	0.6%	=TEXT(C118,"0.0%")
0.56%	1%	=TEXT(C118,"0%")
0.56%	.6%	=TEXT(C118,".0%")

You can also use the concatenate function to achieve the same results.

The formula:

=CONCATENATE("The net present value is ",C82," and the internal rate of return is ",C83)

Yields:

The net present value is 1805549.38574101 and the internal rate of return is 0.406744551557681

Here the text and cell references all appear within the concatenate function separated by commas.

To "clean up" the results, wrap the cell reference numbers in the text function.

To get this result:

The net present value is $1,805,549 and the internal rate of return is 40.67%.

Use this formula:

=CONCATENATE("The net present value is ",TEXT(C82,"$#,000")," and the internal rate of return is ",TEXT(C83,"0.00%"))

CONCLUSION

The Microsoft Excel program contains many features useful for financial analysis. This paper demonstrates how five functions can be applied. The features are: the ***choose*** function to create scenarios, ***data validation*** to restrict selections, ***data tables*** for sensitivity analysis, ***conditional formatting*** to highlight key results and scenarios under consideration and ***concatenation*** to string together text and formula results. Interested users may access the accompanying excel file by emailing me at lyonsb@sacredheart.edu.

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Creating Depth of Knowledge Using Team-Based Research Projects in Money and Banking and Financial Markets Courses

Bradley Hobbs and Daniel J. Borgia

Many undergraduate programs enroll students in a Money and Banking or Financial Markets course just after completing the principles of economics or an introductory financial management course. As professors who have taught Money and Banking and Financial Markets courses over a number of years, we have often faced a conundrum. Students note in their evaluations and comments that the course content tends to be "a bit dry" when compared to their experience in introductory courses. As a result, in developing our financial markets course, we have incorporated a project that has helped to engage students. Student responses indicate success in making the material more pertinent, engaging, and accessible.

Our "Financial Markets Project" requires students to produce a comprehensive, structured analysis of a specific financial market instrument or, alternatively, some institutional aspect of financial markets. After completing the project, students are required to present their findings to the class. This project helps students to develop skills they will need in their subsequent academic and working lives, such as: organizing and conducting research; collecting, sorting and analyzing data; writing and editing their findings; and publicly presenting their results to a peer audience. The entire project is carried out

using the Microsoft Office® Suite so students also develop technical proficiency with spreadsheets, presentation software, and simple statistical techniques. Analytical prowess is required in developing the statistical relationships and in presenting and explaining statistical results. This project is important for students because it helps them to develop complex critical thinking and writing skills along with vital presentation and public speaking competencies.

THE FINANCIAL MARKETS PROJECT

The *Financial Markets Project* begins by organizing students into randomly selected teams of three to five people. Each team then picks from a list of topics focusing on either financial market instruments or institutions (see Exhibit 1.) Each team is allocated 100 points and can assign these points to any single topic or to any set of topics as they wish. The bids are then submitted in a closed-bid bidding process, rank-ordered and the team bidding the highest number of points "wins" that topic. The process is repeated until all topics are covered and all teams have an assigned topic.

The basic goal of the project is for students to familiarize themselves with modern financial market instruments and financial institutions. In the past, students have produced reports analyzing and discussing U.S. Treasury bills, repurchase agreements, federal funds, commercial paper, federal agency securities, banker's acceptances, Eurodollar deposits, municipal bonds, treasury bonds, corporate bonds, options, hedge funds, convertible bonds, and basic foreign exchange markets. In some cases, similar financial instruments are grouped together. On the institutional side, topics have included the Sarbanes-Oxley Act, savings and loans, credit unions, pension plans, insurance and reinsurance, hedge funds and venture capital firms. The format of the institution papers is less structured allowing for more variation in the format and presentation of materials to the class. This allows students who like more structure to develop a financial instrument paper and those who prefer less structure to develop a financial institutions paper. Both types of papers employ the same grading rubric and process: the difference is in the structured outline provided for financial instruments.

Where students choose a financial instrument topic, we provide them with the Financial Instrument Report Assignment (Exhibit 2.) Regardless of topic, students are required to write a written report and to construct and present a Microsoft PowerPoint® presentation to the class. Each presentation is limited to 25 minutes, including questions. A presentation grading rubric (Exhibit 3) is completed during the presentation and the presenting teams meets with the professor, in office, just after the end of the class for concise and immediate feedback [We have also experimented with peer feedback allowing students to "grade" peer presentations. This allows students to think more critically about presentation skills and pitfalls.]. Presentations are graded and account for 25 percent of the project's grade. This presentation develops and reinforces communication and PowerPoint® skills. Over the years we have incorporated some basic rules for these presentations. The major suggestions for students are as follows: limit the number of topics per slide, make sure the slide is readable from the back of the room, and avoid, at all costs, reading the slides to your audience. For a teaching professor, and for many students, two excellent criticisms of Power Point to draw upon are available from Edward Tufte:

(http://www.edwardtufte.com/tufte/powerpoint)

and Peter Norvig

(http://www.norvig.com/lancet.html).

Both are provided for students via links on our web pages.

Students are also required to produce a written report. This written-paper requirement has evolved, we believe, to provide an improved experience for students and professors. For instance, poor writing quality - combined with our own consternation regarding the pedagogical value of meticulously-graded papers languishing in boxes in our offices - spurred us to adopt a formative three-stage writing process. This provides the professor the opportunity to have periodic feedback loops. Another change has been to have each team choose a student to act as "Team Editor". This has helped to reduce repetition and provide a more unified tone and tenor for the paper.

As noted, the three-stage writing process gives us the opportunity to "coach" students at various stages of the project. An extensive paper grading rubric is provided for each team (Exhibit 4.) Stage I requires the students provide either a thesis statement or short paragraph defining their topic succinctly, and provide a bibliography in MLA format with a minimum of eight to ten resources. This allows us to assess topic definition and the quality and appropriateness of references at about two weeks into the project.

Stage II begins occurring about six weeks into the project with an in-class presentation and the Stage II paper. Presentation dates follow the topic outline and are provided at the time the topics are assigned. The paper each team hands in is "required" to be the group's "Best Final Draft." The paper is then thoroughly marked and edited for course content and writing, with specific suggestions for improvements, editing, and questions written by the professor on the draft. The paper is then returned to the team *without an assigned grade.* Students do receive the feedback on the paper itself and also a completed grading rubric for Stage II. Once the edited paper is returned, each team must decide whether they will respond and resubmit, or simply turn in a clean copy of the paper, as is, for their final grade.

One potential pitfall is that students might hand in "rough" drafts expecting the professor to do their editing work for them. We address this by explaining that meaningful feedback can be given only to meaningful work. Students are told prior to submitting Stage II papers that the instructor has the option to stop reading and providing editorial feedback, after reading two pages of the paper if the attempt is clearly not a strong one. Periodically, students have tested this policy. It is our experience that once a professor follows through and returns a poor paper or rough draft without comment and feedback, the student grapevine provides an amazingly efficient signaling mechanism. In short, consistently using this approach has minimized poor Stage II submissions. Students are also instructed that for Stage III grading simply addressing Stage II feedback is a necessary condition, but not a sufficient one and will not necessarily guarantee a high final grade. We have found, not surprisingly, that conscientious responses to Stage II feedback do tend to increase grades overall on this assignment.

Students have one week from return of Stage II papers to produce their Stage III or final paper. These are justifiably held to high standards: flow, cohesiveness and clarity are crucial. The final paper itself is read but not marked. We read these papers as a holistic piece without reference to Stage II feedback, and then we complete the Stage III grading rubric and assign a final grade. This approach reduces the amount of grading time and allows the professor to read the piece without the interruptions of marking the paper itself.

The inevitable free-rider problem is dealt with in a forthright fashion: we require all students to assess the work of fellow team members. Students are instructed to: 1) identify the three major tasks they were assigned in the project, and 2) to "grade" the contributions of their fellow team members. This peer feedback is handed in a sealed envelope with the Stage III paper. The Peer Evaluation Grading Rubric (Exhibit 5) provides space for each student identify the major tasks that they were responsible for and then to assign points indicating the contribution of their peers in the overall project. The total point allocation available is calculated as [(100 points) X (the number of team members – 1)]. Students can assign the total points in any way they choose among their fellow team members. For example, if there are four team members there are 300 total points to assign ([(100 points) X (4– 1)] = 300.). If the student judges that all team members contributed equally then she could assign 100 points to each team member. If, on the other hand, there was problem student, his or her team member can assign a value lower than 100 and add those points to those who contributed more. Students are instructed to assign points as they see fit and we have found them to be quite forthright and conscientious in the peer evaluation process. Peer grades are used to adjust the project score down if a major problem is identified in this process. It is important to clearly state these processes in the syllabus. It has been our experience that this process not only identifies free-riders, but also allows us to adjust the grades of free riders with explicit feedback from peers once the project is completed.

The *Financial Markets Project* format we have developed helps us to emphasize writing and research as a *process.* Students' come to the realization that writing is an iterative craft requiring multiple drafts and ongoing editing. Stage I and Stage II feedback give them the opportunity to improve this specific work and to simultaneously improve their writing, communication and presentation skills more generally. It has also been our experience that final papers have improved significantly. At the margin, the work for the professor is not significantly changed. Simply grading final papers requires the same intense feedback as Stage II papers but provides neither an opportunity for students to address criticisms nor a chance to employ an iterative process designed to actually improve their work. While we do read the paper twice we have reduced grading time by moving from individual papers to group papers. The use of presentations also reduces lecture time and provides a more interactive, active-learning format for about one-third of the course. It is our experience that overall workload is actually reduced when compared to individual papers without student presentations. A sample student project is included as Exhibit 6. The accompanying student project PowerPoint presentation can be downloaded at the JITF website.

Finally, student feedback has been, on the whole, positive. Group work is often cited as the major downfall so students are reminded that in their future employment it is highly unlikely that they will be able to choose their own team mates and that they may, one day, be in a position to judge the works of peers as a supervisor or in some 360-degree evaluation process. A selected group of comments follows: "The presentations really made us learn the material."; "I also enjoyed the group project, it taught me a lot about my topic and I enjoyed interacting with my classmates."; "I wish I could have picked my own group for the project, but that is not the real world! I like your method for picking topics for the presentation."; "The feedback was great and helped us to EARN a better grade!"; "I feel the project was a huge learning opportunity and encourage you to continue with it."; and finally, "Although I tend not to like group projects, I had an excellent experience with my group in this course. I was actually able to benefit from having team members which was a great experience for me. Also, the project helped me to learn more about our topic."

CONCLUSION

The impetus for the initial development of the *Financial Markets Project* was to engage students more deeply in the course material and to improve group work, writing and presentation skills. After more than a decade of using these methods, we find that the number of problems has been relatively few and we have observed a marked improvement in the final Stage III papers. Student evaluation comments on the project are generally positive. We suggest explaining the reasons for requiring group work, presentations and an iterative writing process to students to increase their awareness of the project's purposes. The *Financial Markets Project* brings together many of the traditional and technological skills that are part of a university education while developing research, writing, presentation and software skills necessary for a 21st century professional career.

The following exhibits, available at www.jfcr.org/jitf, provide the topics list, report assignment, presentation and grading rubric, and a sample paper referred to in the article:

List of Exhibits

Exhibit 1. Financial Markets Instruments or Institutions – Topics List
Exhibit 2. Financial Instrument Report Assignment
Exhibit 3. Presentation - Grading Rubric
Exhibit 4. Paper - Grading Rubric
Exhibit 5. Peer Evaluation - Grading Rubric
Exhibit 6. Sample Paper

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A Virtual Trading Project for the Derivative Securities Course

Stephen C. Henry

In this paper, I present a simulated trading project for the undergraduate Derivative Securities course which allows students to realistically trade both Futures and Option contracts. The project makes use of the Virtual Trading tool provided on the Chicago Board Options Exchange website, which processes virtual trades in real time using actual market data.

Student response to the project's first implementation in Fall 2008 has been overwhelmingly positive. I provide Likert-style survey results describing students' perceptions of various aspects of the assignment, and identify directions for potential future modifications.

INTRODUCTION

Numerous studies exist which support the notion that experience plays an important role in the learning process. Consequently, experiential learning activities have become an important part of the curriculum for courses of all types. "Bridging the gap" between theory and practice is important in all business disciplines, and is especially critical for investment-related Finance courses. Each year, business schools and their faculty members spend a great deal of time and money in an effort to deliver "real-world" experiences and activities for such courses; stock tickers, market simulations, trading rooms, and the like. However, developing activities of this sort for courses in derivative securities has been a challenge, at least when working within a limited budget. While several fee-based online services offer simulated trading of stocks (Stock-Trak for example), none seem to offer adequate handling of option trades. Most option courses provide at least some coverage of complex order types (spreads, straddles, etc.), which are not accommodated in most stock-oriented simulations. Furthermore, in order to be effective, a simulation should take into account both the interplay of stock and option prices, and the varying liquidity of different contracts. Essentially, this means that actual option trading data must be used as the basis of the simulation. Fortunately, the Chicago Board Options Exchange provides a trading simulation that incorporates these features.

THE CBOE VIRTUAL TRADING FACILITY

The CBOE virtual trading facility[1], available at no cost to users, has a number of features which make it a valuable resource for derivative securities courses. First, it allows for seamless trading of both futures and options within the same account. Second, it automatically handles the more mundane bookkeeping aspects of such a project, recording trades, deducting commissions, and providing periodic status reports, and an end-of-semester summary of the results. Also, complex order types such as spreads and straddles are easily entered and unwound. Most importantly, perhaps, the results of simulated trades are based on actual CBOE trading activity.

Trading of derivative securities based on real-world data gives students a much better grasp of the subtleties of the marketplace than fictional examples can provide. For instance, as option expiration dates approach, students are likely to witness the implied volatility collapse on option positions held for too long. Also, since the simulation only executes virtual trades when compatible actual trades occur, students may encounter problems unwinding some positions. As a result, they are forced to be mindful of the liquidity of the contracts they choose. An awareness of such market imperfections is one of the key insights delivered by this real-data simulation.

THE TRADING PROJECT

In teaching a course in futures and options markets, I have developed a class assignment which makes use of the features of the CBOE virtual trading tool. In order to offer students as much flexibility as possible in choosing their strategies, the requirements specified for the assignment are fairly limited. Students were to begin with an initial endowment of $100,000 in their virtual trading accounts, and were required to allocate at least $75,000 to option trades (the rest could be in stocks, futures, or simply held as cash; option trading is emphasized in this assignment)[2].

In order to discourage "all or nothing" speculative trades, I required students to allocate their option trades across at least four different underlying assets, and to take at least one *bearish* and one *bullish* position. In this way, students were encouraged to do a bit of company research in order to choose the best strategies. Any assets with CBOE-traded options were fair game, including equities, indexes, and interest rates. Most students, however, limited their trades to individual stock options. Students were encouraged (with bonus points) to develop complex orders such as spreads and straddles, and many chose to do so.

At the end of the semester, class members were required to hand in an accounting of all of their trades, an analysis of the outcomes (including transaction costs), and a report of their overall gains or losses on a weekly basis. The CBOE system makes this easy, and by having students utilize the standard reports, I have some external assurance that trades were actually entered when reported. It's important to make students aware that they MUST track the progress of their trades during the project; unlike stocks, historical option prices are not

readily available, thus it is impossible for them to go back after the fact and construct trades they "would have made" in previous weeks. A copy of the assignment page I distributed to students is included in the appendix as an example.

SURVEY OF STUDENT PERCEPTIONS

At the conclusion of the Fall 2008 semester, I administered a brief survey to students in order to gauge their perception of the value of this assignment in the context of the rest of the course. Results of the survey are presented in Table 1. Although inference is questionable with such a small sample size, *t*-statistics and associated probabilities are reported for a two-tailed test of the hypothesis that the mean of responses is equal to three (the "neutral" response to each question). In general terms, the results suggest that: (1) Students found the futures trading project (which did not utilize the CBOE system) more difficult than the options trading project. (Admittedly, it is not necessarily the case that use of the virtual trading system is the reason for the difference in perceived difficulty). (2) Students perceived the trading project to be valuable in gaining an understanding of the mechanics of these marketplaces. And (3), the CBOE system was a valuable resource in completing the assignment.

CONCLUSION

Although the survey responses are interesting, the informal feedback I received from students regarding this project was far more gratifying. Class members were much more engaged with the class material during the project, and many apparently found the project to be quite enjoyable. Having taught the course for several years prior to using the virtual trading system, I had continually struggled to keep the students engaged and connected to the real-world mechanics of option marketplaces. The CBOE Virtual Trading system has been of immense benefit, and will remain an important tool for me in future courses.

1.http://www.cboe.com/tradtool/virtualtrade.aspx

2. When I originally developed this assignment, the CBOE virtual trading system was set up to accommodate trading in futures contracts, and a part of the assignment was dedicated to futures trading. However, I found the futures portion of the system to be unreliable, often failing to execute valid trades. Consequently, I did not endorse the use of the CBOE site for the futures trading portion of the project. Hopefully, future improvements to the system will make it usable for the futures component of the course.

Statistical results of the student survey and a copy of the trading assignment are available on the website (www.jfcr.org/jitf).

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Using Mortgage Rates to Explain Risk Premiums in an Introductory Finance Course

Kenneth P. Moon and Glenn Tanner

Devising an effective way to teach interest rate determinants and help students understand various risk premiums is an essential part of any introductory finance course. Unfortunately, because these topics are commonly taught in conjunction with the introduction of bonds, students often become confused while trying to simultaneously learn new terminology and concepts related to bond pricing. In this paper, we describe a more student friendly approach to teaching interest rate determinants. We believe students gain a better understanding of risk premiums when related to loan types they are already somewhat familiar with. Specifically, this paper describes how to use a simple comparison of various mortgage rates to more clearly explain concepts such as default risk, interest rate risk, and liquidity risk. This approach focuses students' attention on the concepts at hand rather than confusing them with multiple high level applications at one time.

INTRODUCTION

Introducing interest rate determinants in an introductory finance course is one of the most crucial lessons of the semester. Understanding the risk premiums built into required returns is vital for comprehending asset pricing, which is perhaps the most important topic in finance. Generally, instructors introduce interest rate determinants using bond yields. We advocate the use of mortgage loan rates for several reasons:

1. Introductory finance students are generally unfamiliar with bonds, which are a confusing topic by themselves for many students. Students are much more likely to be familiar with traditional amortizing debt, such as car loans and student loans, which will ease the understanding of rate determinants.
2. Learning about the different mortgage types is more "real-world" useful for many students. Undergraduate business students tend to have a range of majors, many of which may not encounter bonds in their career, but most of which will look into mortgage loans later in their lives. Many graduate students may have already experienced shopping for a mortgage.
3. Finally, introducing the different types of mortgages will advance students' understanding of some of the issues contributing to the current financial crisis. Specifically, students will become aware of the secondary mortgage market, Fannie Mae, and Freddie Mac.

This paper describes how interest rates determinants can be introduced via mortgage rates and provides some examples and data that can be used to reinforce specific learning outcomes.

EXTENDED FISHER EQUATION

Irving Fisher first proposed the basic interest rate determinants in his 1930 book, *A Theory of Interest*. Fisher first postulated that a risk-free return can be expressed as the product of the real interest factor and an expected inflation factor. The simpler approximation can be written as:

$$r_{nomimal} = r_{real} + E[inflation]$$

Fisher's equation can be extended to risky assets by adding risk premium (RP) terms:

$$r_{nomimal} = r_{real} + E[inflation] + default\ RP + interest\ rate\ RP + liquidity\ RP$$

Bankrate.com provides current data on several different types of mortgages, including:

30-, 20-, 15-, and 10-year fixed rate (FRM)
30-year 3/1, 5/1, 7/1, and 10/1 adjustable rate (ARM)
Jumbo mortgages for many of the above (Jumbo)
Interest-only versions of the ARMs (IO)

See Table 1. Each of these mortgages brings different levels of risk to the transaction, thus the risk premiums and initial interest rates will vary. Using this data, it is relatively simple to explain and isolate each type of risk premium using pairs of mortgages. Data displayed in Table 1 come from Bankrate.com, and provide the basis for the various premiums discussed in Table 2. The historical data series displayed in the Figures are weekly frequency obtained from Bloomberg.

DEFAULT RISK PREMIUM

The default risk premium is relatively intuitive – the more likely the borrower is to fail to repay the loan, the higher initial rate the lender will charge. Default risk is perhaps the most manageable risk for lenders, as the lender can limit default risk by verifying that the borrower has adequate income to repay the loan, a sufficient down payment to reduce the likelihood of default, and an established credit history. All else equal, adjustable rate mortgages would be expected to have higher default risk than fixed rate mortgages because rising interest rates could cause monthly payments to become unaffordable. However, lenders have traditionally managed this extra risk by imposing tighter underwriting standards on ARMs. For example, Fannie Mae's conforming underwriting standards once required that borrowers' monthly housing costs (loan payment, hazard insurance, and property taxes) could be no more than 28% of their gross monthly income for FRMs, and no more than 25% for ARMs. Thus, varying default risk premiums are not extremely evident across ARMs and FRMs.

However, additional default risk premiums may be seen in interest-only (IO) loans. The risk of default tends to decline as time passes with traditional amortizing loans, because the decreasing loan balance means that the borrower is building up more equity even if the property's value stays constant or declines slightly. With IOs, however, a borrower making the minimum monthly payments will only see his equity rise if the property's value rises. That additional default risk can be seen in the premiums of IO rates in Panel A of Table 2. For example, the rate on the 5/1 IO is 0.15% higher than the rate on the amortizing 5/1 ARM, and for the 7/1 IO, the additional default risk premium is 0.14%. This premium for IO ARMs relative to regular ARMs pinpoints the concept of default risk before the introduction of bonds and without complexities such as credit rating agencies and the various characteristics of bond issuers. Focusing the student's attention on a simple comparison of mortgages rates greatly enhances their comprehension of the topic at hand.

INTEREST RATE RISK PREMIUM

Using loans rather than bonds, the interest rate risk premium is also easy to explain – for a lender, interest rate risk occurs when the lender is not allowed to charge the market rate. That is, when a lender makes a 30-year mortgage loan at 6%, the lender loses if rates rise to 7% the next day because he has committed to providing funds at a (now) below-market rate for up to 30 years. As compensation for that risk, the lender will charge a higher initial rate on the 30-year loan than he would on a loan of shorter term.*

In times of normal, upward-sloping yield curves, interest rate risk premiums are extremely easy to see – all else equal, the longer a lender is locked into a rate, the more interest rate risk he faces and the higher the initial interest rate will be. Panel B of Table 2 displays this concept both for fixed-rate mortgages of differing maturity as well as 30-year mortgages with various initial rate lock lengths. Part 1 of Panel B displays the concept for fixed rate mortgages of varying maturity. As expected, the 10-year rate is the lowest of the FRMs, as the lender is only committed to offering the borrower that rate for 10 years. The 30-year rate is 63 basis points higher, as the lender is committing to the rate for a much longer period and thus is taking on much more risk in the event of an immediate increase in market rates. It is worth noting to students that risk premiums are not constant over time. Lenders would tend to charge a higher interest rate risk premium in times when they are more risk averse or when they believe rising rates are more likely. Using weekly data from Bloomberg, Figure 1 displays how these rates and the premium have changed over the past six years. While the 30-year rate on average was 0.44% higher than the 15-year rate, that premium reached as high as 0.72% in February 2004 and dropped as low as 0.07% in December 2009.

The interest rate risk premiums can also be seen in the ARMs. Part 2 of Panel B compares the rates for ARMs with varying rate-lock periods. As mentioned above, the longer the rate lock the more of an interest rate risk premium the lender will demand. The 5/1 ARM is a 30-year mortgage where the initial rate is locked for five years, then adjustable yearly afterwards. Likewise, the 7/1 ARM has a locked rate for the first seven years, while the 10/1 locks the initial rate for the first decade. As expected, the rates rise as the length of the initial rate lock increases because the lender is facing a longer period of interest rate risk. This is clearly seen in the reported premiums.

The premium for the 7/1 ARM versus the 5/1 is 0.32% and 0.59% for the 10/1 ARM relative to the 5/1 ARM. Again, it is easy to focus the discussion on the concept of interest rate risk and the associated premium before the complexities of bond pricing are introduced.

LIQUIDITY RISK PREMIUM

Finally, relative to bonds, mortgages much more clearly explain liquidity risk premiums. Liquidity risk arises from the uncertainty about being able to quickly sell an asset at market price. In bond markets, some types of bonds are more actively traded than others, but without having a matched pair of bonds that are identical except for trading volume it is difficult to isolate a liquidity risk premium. The secondary market for mortgages provides an extremely clear example. Mortgages can be separated into two types – those that conform to Fannie Mae and Freddie Mac's underwriting standards and those that do not. The most common type of non-conforming mortgage is a "jumbo" mortgage, which has an original loan amount that exceeds the agencies' limit (currently $417,000 for a single-family home in most of the country). In the past decade Fannie Mae and Freddie Mac have been the dominant buyers in the secondary mortgage market, with a combined market share above 50% in most years and above 80% in the most recent years. Thus, while a lender who makes a conforming mortgage loan may sell it to any buyer in the secondary market, a lender who originates a jumbo loan has eliminated the two largest and most dependable potential buyers of mortgage loans. Therefore, the jumbo loan will be more difficult to sell, and the lender will charge a higher initial rate because of this liquidity risk.

Panel C of Table 2 shows just one pair of mortgages that could be used to isolate a liquidity risk premium, as there are jumbo versions of most of the FRMs and ARMs. As displayed in the Table, the conforming 30-year FRM has a 5.08% rate, while its Jumbo equivalent is charging 5.91%. The 0.83% premium reflects the additional risk that a jumbo lender would face trying to find a secondary mortgage market buyer other than Freddie Mac and Fannie Mae. The premium also experienced significant volatility in the recent mortgage crisis, as shown by Figure 2. The premium historically had been fairly stable around 0.25%, but spiked suddenly in August 2007 and eventually peaked at 1.82% in February 2009, as private buyers of mortgage-backed securities fled the secondary market and liquidity in the jumbo mortgage markets disappeared.

CONCLUSION

Identifying a straightforward and concise method for teaching advanced concepts in finance has long been a struggle for many professors. One such challenging area is effectively teaching students in introductory finance courses the concepts related to various risk premiums. Introductory textbooks usually combine the concept of risk premiums with the fundamentals of bond prices and bond yields. We believe this approach unnecessarily complicates the processes. Students are much more receptive and gain a more thorough understanding when rate premium concepts are explained in the context of comparing rates on financial instruments that are more familiar to them, such as amortizing loans, then proceeding to bond pricing. Further, this type of an approach proves to be more beneficial to many students who are highly unlikely to encounter circumstances involving complex bond issues, whereas most will eventually deal with issues related to home mortgages. Accordingly, the approach is not only more tractable but also more practical for the typical business student.

*If students already have a basic understanding of bond pricing fundamentals, the interest rate risk premium can also be explained by introducing the secondary mortgage market. Most lenders now do not hold the mortgage loans they originate, but rather sell the loans in the secondary mortgage market, where the most active buyers are Fannie Mae and Freddie Mac. Though much more complex, mortgage pricing basics are similar to bonds, with the interest rate on the mortgage being equivalent to the bond coupon rate and the loan balance being analogous to the bond's face value. The instructor can readily describe that if market interest rates rise above the loan interest rate (coupon rate), the mortgage (bond) will sell at a discount to its loan balance (face value).

REFERENCES

National Overnight Average Mortgage Rates. Retrieved from http://www.bankrate.com.

Historical Weekly National Average Mortgage Rates. (April, 2003 - April, 2009). Data retrieved from Bloomberg L.P. Financial Services.

Table 1. Example National Mortgage Rates (from www.Bankrate.com)

Mortgage Type	Today	Last Week
30 yr Fixed	5.08%	4.99%
20 yr Fixed	5.41%	5.16%
15 yr Fixed	4.48%	4.55%
10 yr Fixed	4.45%	4.43%
30 yr Fixed Jumbo	5.91%	5.82%
15 yr Fixed Jumbo	5.47%	5.37%
3/1 ARM	4.95%	4.96%
3/1 ARM I/O*	5.43%	5.40%
5/1 ARM	4.34%	4.39%
5/1 ARM I/O	4.49%	4.46%
7/1 ARM	4.66%	4.79%
7/1 ARM I/O	4.80%	5.08%
10/1 ARM	4.93%	4.90%
1 yr Jumbo ARM	4.05%	4.20%
3/1 Jumbo ARM	5.12%	4.52%
3/1 Jumbo ARM I/O	5.34%	4.38%
5/1 Jumbo ARM	4.95%	4.68%
5/1 Jumbo ARM I/O	5.19%	4.75%

*I/O represents Interest Only.
National Overnight Average Mortgage Rates.
Retrieved from http://www.bankrate.com.

Table 2. Mortgage Rate Risk Premiums.

Panel A – Default Risk Premium*

	Term	
	5/1	7/1
Interest Only ARM	.49%	4.80%
Regular ARM	4.34%	4.66%
Default Premium	.15%	.14%

Panel B – Interest Rate Risk Premium**

Part 1 – Time-to-maturity premium

	Term		
	10 Years	15 Years	30 Years
Fixed Rate	4.45%	4.48%	5.08%
Default Premium	.03%	.60%	N/A
Longer Term – Shorter Term	.63%		

Part 2 – ARM Varying Rate Lock Lengths

	Term		
	5/1	7/1	10/1
Regular ARM	4.34%	4.66%	4.93%
Default Premium	.32%	.27%	N/A
Longer Term – Shorter Term	.59%		

Panel C – Liquidity Risk Premium

	Term	
	15 Years	30 Years
Fixed Jumbo	5.47%	5.91%
Regular Fixed	4.48%	5.08%
Liquidity Premium	.99%	.83%

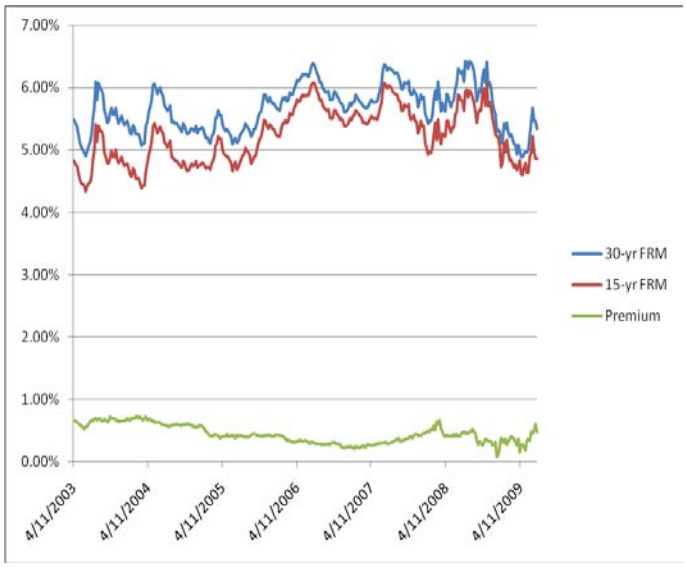
	Term	
	3/1	5/1
Jumbo ARM	5.12%	4.95%
Regular ARM	4.95%	4.34%
Liquidity Premium	.17%	.61%

*Note: The 3/1 mortgage is rarely offered by lenders, thus the "national average" rates that Bankrate.com reports can be misleading, and are therefore excluded.

**Note: The 20-year mortgage is rarely offered by lenders, thus the "national average" rates that Bankrate.com reports can be misleading, and is therefore excluded.

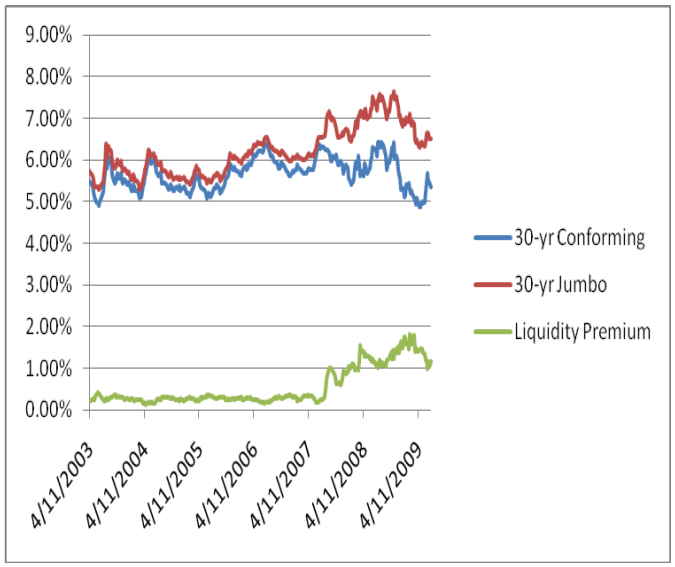
Premiums given in Table 2 come from data provided in Table 1. Table 1 data is from Bankrate.com.

Figure 1. Fixed Rate Mortgage Interest Rate Risk Premiums



Historical Weekly National Average Mortgage Rates. (April, 2003 - April, 2009). Data retrieved from Bloomberg L.P. Financial Services.

Figure 2. 30-Year Fixed Rate Mortgage Liquidity Risk Premiums



Historical Weekly National Average Mortgage Rates. (April, 2003 - April, 2009). Data retrieved from Bloomberg L.P. Financial Services.

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A Method for Teaching the Black-Scholes Option Pricing Model Using Excel

Steve Johnson and Robert Stretcher

One of the most important concepts in modern finance practice and education is option pricing. The Black-Scholes model of option pricing is possibly the most commonly-used model. This paper presents an implementation of the Black-Scholes model of option pricing that includes graphs of the option value, the intrinsic value, and the time value. These graphs are dynamic, allowing the user to change the value of the volatility of underlying asset returns, time to maturity, and the risk-free rate. The user can also see how price of an option changes with movements in the underlying asset price. By illustrating both option prices and the components of option prices (intrinsic and time value) over a range of underlying asset prices, students can more easily visualize the effects of the drivers of option prices.

INPUT VARIABLES

The first step in designing the spreadsheet is to list the input variables. These are recorded in table 1.

Table 1: Input variables.

S_0,	the current price of the underlying asset
Strike,	the strike price of the option
Rf,	the annual risk-free rate
Time,	the time until maturity, measured as a fraction of a year
sigma,	the standard deviation of the returns of the underlying asset.

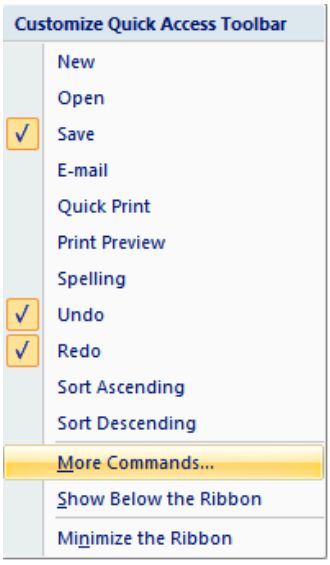
The five input variables, S_0, Strike, Rf, Time, and sigma are all derived from spin button outputs. A spin button is a convenient input variable adjustment tool to use with the model in Excel 2007. The first input variable, S_0, is used here as an example.

First, in order to be able to conveniently add spin buttons to the spreadsheet, add the spin button icon to the Quick Access Toolbar. Once the icon is added, it will be available every time the spreadsheet is opened. Click on the "Customize Quick Access Toolbar" icon. This icon is the right-most icon in the toolbar. See figure 1.

Figure 1: Customize Quick Access Toolbar icon.

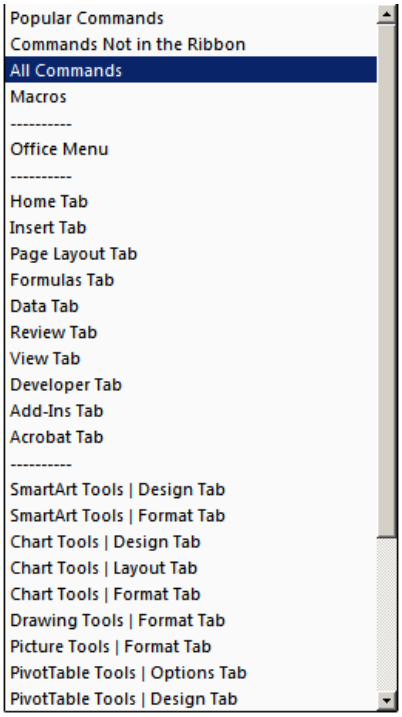
Scroll down to "More Commands." See figure 2.

Figure 2: Select "More Commands."



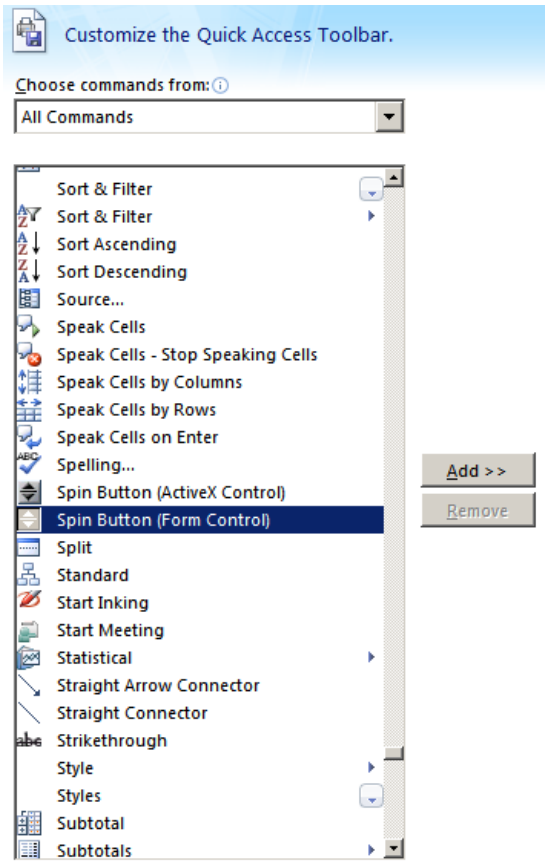
Select "More Commands," then choose "All Commands." See figure 3:

Figure 3: All Commands.



After choosing "All Commands," scroll down to and select "Spin Button (Form Control)," then click on Add. See figure 4:

Figure 4: Add Spin Button (Form Control).

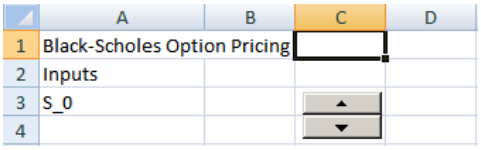


After clicking on Add, it should be possible to see the spin button icon in the toolbar. The updated toolbar is illustrated in figure 5.

Figure 5: Excel toolbar with spin button icon.

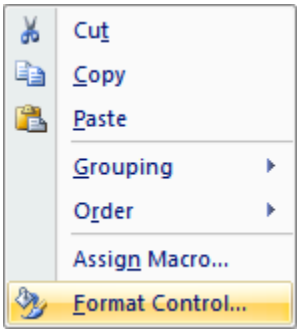
Enter the text, "Black-Scholes Option Pricing" in cell A1 and "Inputs" in cell A2. In cell A3, enter the text, "S_0." This is the name representing the value of the underlying asset. Next, click on the spin button icon. This will render a "+"-shape that can be used to draw the spin button. Go to the upper left-hand corner of cell C3. Hold down the left mouse button and move to the lower right-hand corner of cell C4. Then, release the left mouse button. The result should be similar to figure 6.

Figure 6: The S_0 (Underlying asset price) spin button.



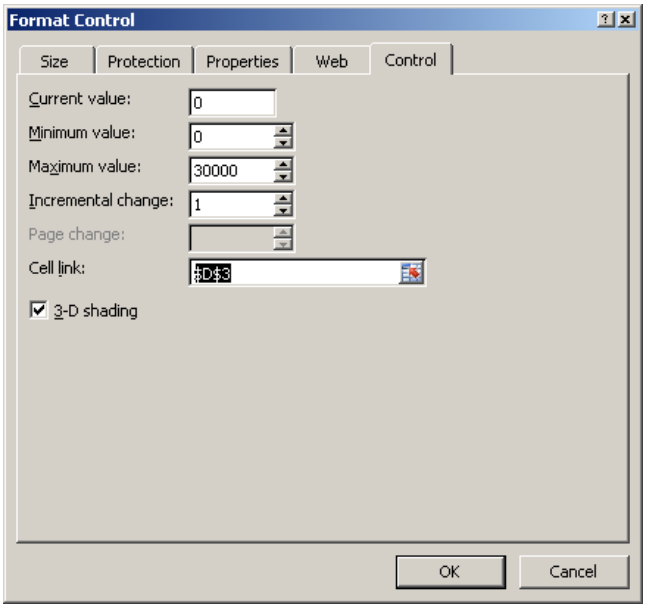
Next, the spin button must be linked to a cell, and then scaled to provide the appropriate range of values. For example, the underlying asset price could be set to vary between $0 and $30 in steps of $0.10. In order to link the spin button output to a cell, right-click on the cell and choose "Format Control." See figure 7.

Figure 7: Choose format control.



After choosing format control, put the cursor next to the box labeled "Cell Link," then click on cell D3. See figure 8.

Figure 8: Format Control with cell link.



Click on OK. This will close the Format Control box. Now the spin button will send its raw output to cell D3. Click on the spin button once. The result should be similar to figure 8.

Figure 9: Spin button that sends raw output to cell D3.

	A	B	C	D
1	Black-Scholes Option Pricing			
2	Inputs			
3	S_0			1
4				

Finally, scale the output to the range and step size needed. Here, the minimum price is set to be \$0 and the step size to be \$0.10. Use the relation

desired output = starting value + (step size) * (# of steps)

The starting value = 0, the step size is 0.10, and the number of steps is the raw output from the spin button, D3. So, in cell B3, enter the formula

= 0 + 0.1 * D3.

Set the range for the input variable S_0 such that $0 \leq S\_0 \leq 30$, which implies: $0 \leq 0+0.1*D3 \leq 30$ or $0 \leq D3 \leq 300$. Open Format Control again and enter the maximum value of 300. This is illustrated in figure 10.

Figure 10: Format Control with maximum value of 300.

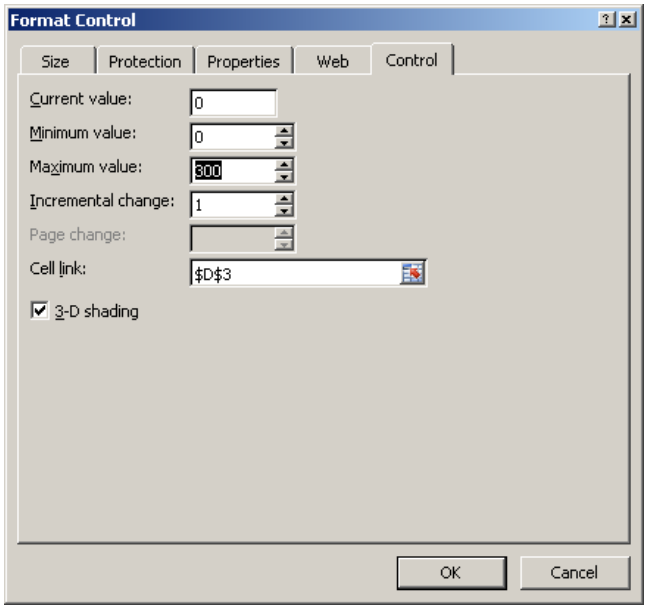


Figure 11 illustrates the final result with the raw spin button output set to 101 and cell B3 formatted to two-decimal US currency.

Figure 11: Final result for the S_0 (underlying asset price) spin button.

	A	B	C	D
1	Black-Scholes Option Pricing			
2	Inputs			
3	S_0	$10.10		101
4				

The next step is to add the other input variables:

Strike, the strike price of the option
Rf, the annual risk-free rate
Time, the time until maturity, measured as a fraction of a year
sigma, the standard deviation of the returns of the underlying asset.

Repeat the process described above for the other input variables. Add the remaining input variables every other row, so that Strike is in cell A5, Rf is in cell A7, Time is in cell A9, and sigma is in cell A11. Insert spin buttons in cells C5..C6, C7..C8, C9..C10, and C11.C12. Use Format Control to put the raw outputs of the spin buttons in cells D5, D7, D9, and D11, respectively. Use the same relation used before in cell B3 for the value of Strike in cell B5. Allow the interest rate (Rf) and the standard deviation (sigma) to vary from 1%, in steps of 0.2%, in B7 and B11, respectively. Allow time to vary from 0.01, in steps of 0.01, in cell B9. The final result should be similar to figure 12.

Figure 12: Input variables: Black-Scholes call option.

	A	B	C	D
1	Black-Scholes Option Pricing			
2	Inputs			
3	S_0	13.6		136
4				
5	Strike	15		150
6				
7	Rf	0.05		10
8				
9	Time	0.5		50
10				
11	sigma	0.2		20
12				

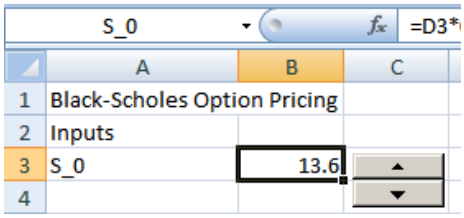
Note that, in order to cap the input values of any of the input variables that feed into the option pricing model, use the maximum option on the Format Control step. For example, it is possible to set upper and lower limits of 1% and 5% for the input variable Rf such that $1\% \leq Rf \leq 5\%$ with increments of 0.2%.

This would imply that

$$0.01 \leq 0.01 + 0.002*D7 \leq 0.05 \text{ or } 0 \leq D7 \leq 20.$$

Use the name box to give each of the values in column B the corresponding name in column A. For example, for cell B3, click on B3, then enter "S_0" in the NameBox immediately above the column header for column A. See figure 13.

Figure 13: Variable name for cell B3 identified in the NameBox.



INTERMEDIATE CALCULATIONS AND CALL PRICE CALCULATION

The next step is to calculate the values, denoted here as d_1 and d_2, of the intermediate step. According to the Black-Scholes theory of option pricing,

call option price = S_0 * normdist(d_1, 0, 1) - Strike * exp(-Rf*Time)*normdist(d_2, 0, 1)

where d_1 = (ln(S_0/Strike) + (Rf + (sigma^2)/2)*Time)/(sigma*sqrt(Time))
and d_2 = (ln(S_0/Strike) + (Rf - (sigma^2)/2)*Time)/(sigma*sqrt(Time))

Enter the text "d_1" and "d_2" in cells A14 and A15, respectively. Enter the above formulas in cells B14 and B15, respectively. Rename cell B14 as d_1. Rename cell B15 as d_2. The result should resemble figure 14:

Figure 14: Input values and intermediate values d_1, d_2.

	A	B	C
1	Black-Scholes Option Pricing		
2	Inputs		
3	S_0	13.6	
4			
5	Strike	15	
6			
7	Rf	0.05	
8			
9	Time	0.5	
10			
11	sigma	0.2	
12			
13			
14	d_1	-0.44534	
15	d_2	-0.58676	
16			

At this point, all the inputs for the calculation of the call price are complete. The Black-Scholes value of the call option with the given inputs is

=S_0*normdist(d_1,0,1)-Strike*exp(-Rf*Time)*normdist(d_2,0,1)

Enter the text "Call Price @ S_0" in cell A17 and the above formula in cell B17. This completes the Black-Scholes pricing of a call option with the above inputs. See figure 15.

Figure 15: Black-Scholes call price calculation for one set of inputs.

	A	B	C
1	Black-Scholes Option Pricing		
2	Inputs		
3	S_0	13.6	
4			
5	Strike	15	
6			
7	Rf	0.05	
8			
9	Time	0.5	
10			
11	sigma	0.2	
12			
13			
14	d_1	-0.44534	
15	d_2	-0.58676	
16			
17	Call price @ S_0	0.384284	

GRAPHS

One of the powerful features of Excel is the ability to create graphs that change when the input values change. Implementing this feature makes it is possible to see what happens to option prices when inputs are changed. In this model, a useful image is a plot of the option value vs. the underlying stock price. Changes in the risk-free rate (Rf), the volatility (sigma) of underlying asset returns, the time to maturity (Time), and the strike price (Strike) impact the entire graph. Changes in the underlying stock price are represented by different values on the same graph. An effective visualization is to sketch four graphs on the same chart. The first three are: the option price, the intrinsic value of the option, and the time value of the option. Also included is a graph of the option price at one point--the value of the underlying stock price found in cell B3.

Enter the following text into the following cells:
"S_0" in cell F1,
"d_1" in cell G1,
"d_2" in cell H1,
"Black-Scholes price" in cell J1,
"Intrinsic value" in cell K1, and
"Time value" in cell L1.

Figure 16: Column headers for graph input data.

F	G	H	I	J	K	L
S_0	d_1	d_2		Black-Scholes price	Intrinsic value	Time value

Enter the value 0.1 in cell F2, then 0.2 in F3, then copy and drag down to cell F301, which should have a value of 30. These will be the "x-values," the values on the horizontal axis, of the graph. These are the different underlying asset prices.

In column G, use the formula for d_1 that was written in B14. However, replace S_0 with the value in column F. In column H, repeat the same procedure for the value of d_2 that is written in cell B15. Copy and drag over G2:H301.

In column J, use the formula for the Black-Scholes call option price found in cell B17. Replace S_0, d_1, and d_2 with the corresponding values from columns F, G, and H, respectively. This way, the spreadsheet will calculate the Black-Scholes call option price for every value of the underlying asset from 0.10 to 30.00.

The intrinsic value of the option is the value if the option were to be exercised immediately. The call option gives the holder of the option the right to buy the underlying asset at the strike price. So, the intrinsic value would be the maximum of either 0, if the strike price is greater than or equal to the underlying asset price, and (underlying asset price - strike price), if the strike price is less than the underlying asset price. In cell K2, enter

= max(0, F2 - Strike)

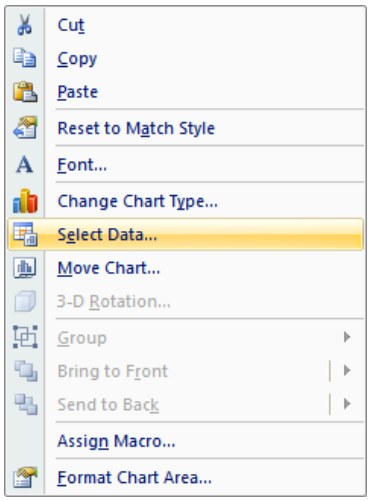
The value of the underlying asset is found in column F. The time value of the option is the part of the option value that comes from the possibility that the underlying asset price might change before maturity. Take the difference of the Black-Scholes call option price and the underlying asset price. In cell L2, enter

= J2 - K2

Copy and drag J1:L1 to J1:L301. This completes the construction of the input data for the graphs.

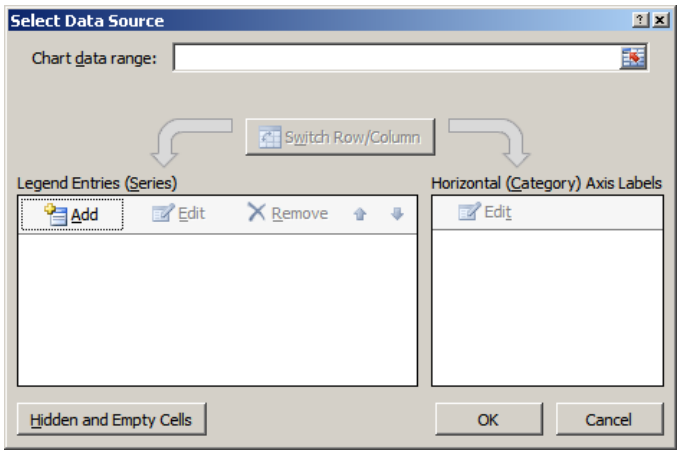
To begin construction of the graph, click on the "Insert" tab, then choose "Scatter," then choose the first option, "Scatter with only markers." A blank graph results. Right-click on the blank graph. Choose select data from the list of options. See figure 17.

Figure 17: Scatterplot options.



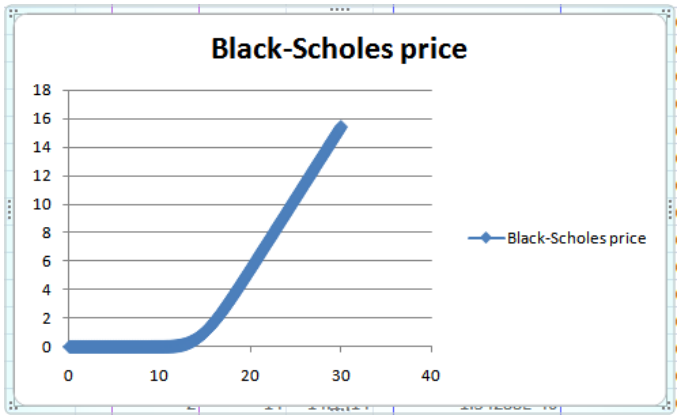
Next, click on "Add." See figure 18.

Figure 18: Selecting the data sources.



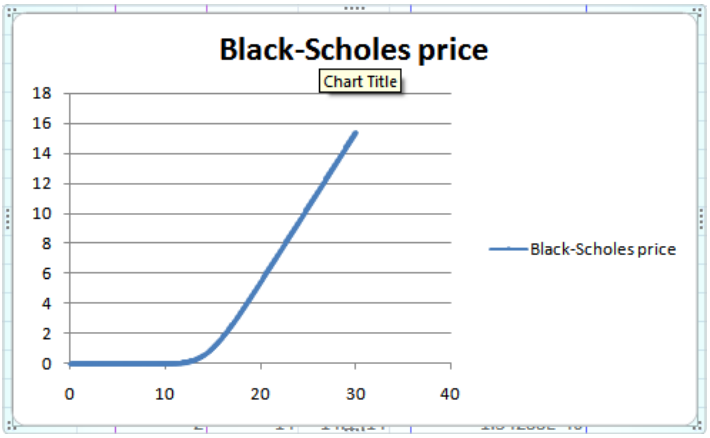
For the series name, click on cell J1. For the x-values, select or enter F2:F301. For the y-values, first delete the text in the box, then select or enter J2:J301. Then click OK. See Figure 19.

Figure 19: Partially completed graph.



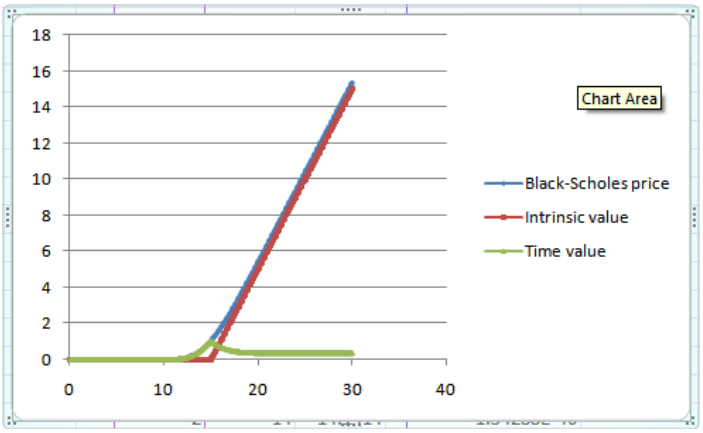
It is possible to make the markers smaller, facilitating reading the graph. Right-click on the curve and choose "Format data series." Click on "Marker options," then "Built-in," then type or enter "2" using the scroll button. Then, click on close. The graph should look like figure 20:

Figure 20: Partially complete graph, with line width adjustment.



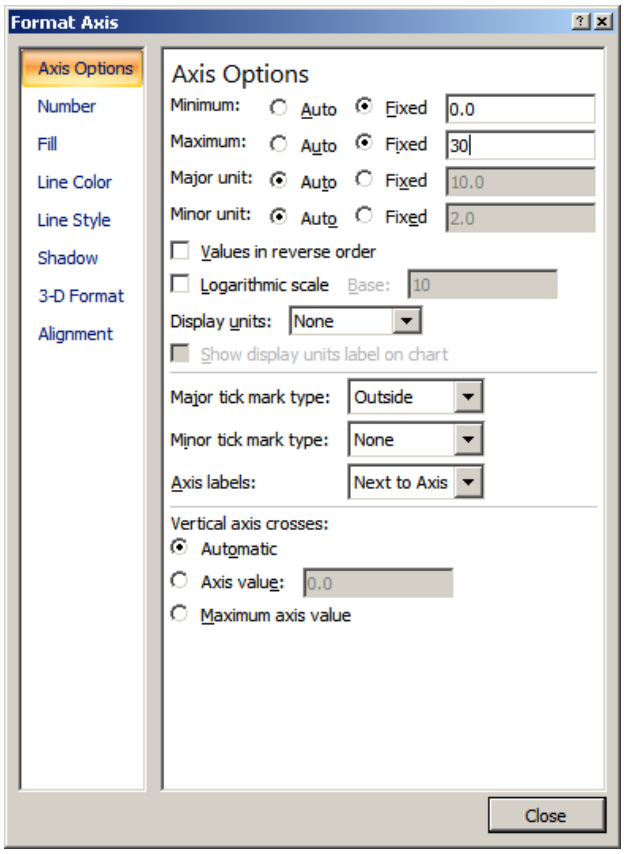
Use the same procedure to enter the graphs of the intrinsic value and the time value of the option. Upon completion, the graph should be similar to figure 21.

Figure 21: Partially complete graph, with option price, time value, and intrinsic value.



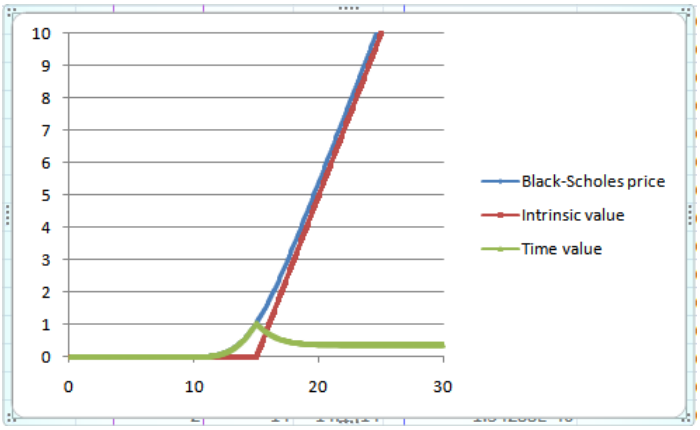
The scale of the graph will need to be adjusted. Since the highest value of the underlying asset is 30, adjust the horizontal axis to display results between 0 and 30 as follows: Right click on one of the values on the horizontal axis. Then, choose format axis. For the minimum value, under "Axis Options," choose "Fixed" and leave the value at 0.0. For the maximum value, choose "Fixed" and enter 30. Then click close. The menu of choices appears in figure 22.

Figure 22: Menu of choices for adjusting the horizontal axis.



For the vertical axis, choose values between 0 and 10. This scale will allow the investigator to see how the option price behaves near the strike price while also allowing observation of some of the behavior when the stock price is more distant from the strike price. Right-click on a value on the horizontal axis of the graph, then follow a procedure similar to that used for the horizontal axis. The graph is now near completion, as can be seen in figure 23.

Figure 23: Partially completed graph, near completion.

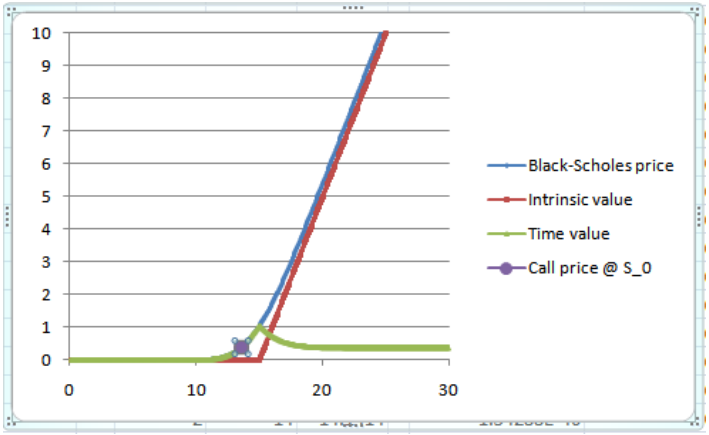


In addition to the three graphs above, it is also of value to observe how the option price changes for different values of the underlying stock price. In this case, all the values lie on the same graph. A single point is added to represent the value of the

option using all five input values. Right-click on the graph, choose "Select Data," then select "Add." The title is found in cell A17, the x-value (just one x-value here) is found in cell B3, and the y-value (the value of the call option at the underlying asset price S_0 found in cell B3) is in B17.

Often the default shape for the fourth graph is an "X," which is hard to see. If this is the case, right-click on the X, choose "Format data series," then "Built in," then select a different shape. For illustration, in the graph, the ball shape has been chosen. See figure 24.

Figure 24: Graph complete except for header.



This completes the graph except for adding a title of one's choice. Move the ball on the graph by clicking on the spin button that controls S_0. Change the graph by clicking on any of the other input variables. In addition to gaining an understanding of how the different input variables drive option prices, the user can also understand how changes in the underlying asset, S_0, reflect changes in the value of the same option contract.

CONCLUSION

The method presented above is a very flexible way to develop a greater understanding of option pricing using the Black-Scholes model. One objective of the construction of this spreadsheet is to provide students an exercise in using the features of Excel to create desired analytical and graphical presentations. Virtually all business school graduates claim expertise in Excel, but few achieve fluency. This exercise can give them a degree of confidence in their abilities if they are required to create the spreadsheet from scratch. In addition, to complete the spreadsheet and graphs, the details of the Black-Scholes model must be translated into an analytical framework. This augments students' understanding of the model and why the option price moves as certain input variables (or distributions) change. It is a much more engaging teaching method than many others.

The preferences presented here, such as structure, input devices, graphical formats, and colors, are of course a matter of taste and can easily be adjusted by the user. In our teaching of the construction of the spreadsheet, students seem to desire an assigned structure rather than being given latitude, at least until after the initial spreadsheet is completed, at which point adjustments can easily be made.

This spreadsheet model can be extended to approximately value stocks that pay dividends. A standard textbook argument (ex Hull 283-5) reduces the problem to two cases: 1) finding the value of the option held until maturity or 2) exercising immediately before the dividends are paid. In case 1), the option holder does not receive the dividends. So, subtract the PV of the dividends from S0, the value of the stock at the beginning of the period. Everything else remains the same. In case 2), the option holder does receive the dividends. So, change the time to maturity to reflect the holder's decision to exercise the option early. Compare the value of the option under both scenarios. The value of the option is the higher of the two values.

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Enhancing Student Understanding of the 1958 Modigliani-Miller Propositions

Dianne M. Lander and Glenn N. Pettengill

In their 1958 paper, Franco Modigliani and Merton Miller show that, in a theoretical "perfect world," a company's value and its cost of capital do not vary across levels of leverage. As a consequence, a linear relationship must exist between the debt-to-equity ratio and the cost of equity. Most textbooks first explore these fundamental theoretical relationships before transitioning on to "real world" issues such as corporate taxes and bankruptcy. In this teaching note, we suggest that textbook presentations of the 1958 MM propositions allow for confusion on the part of students because of ambiguity in discussions and graphical representations. To help avoid confusion on the students' part in this regard, we present a series of exercises that instructors may use to supplement and enhance textbook content.

In 1958, Franco Modigliani and Merton Miller published the first of a series of papers (Exhibit 1) that revolutionized capital structure theory and for which they were presented with the Nobel Prize. In this work, they show by using an innovative arbitrage proof (i.e., the "homemade leverage" argument) that, in a theoretical "perfect world[1]," the value of a company is independent of its leverage[2]. This proposition, known as the Irrelevance Proposition but generally referred to as MM

Proposition I (MMI), implies that a company's average cost of capital is constant across various levels of leverage and, in fact, is equal to its unlevered cost of equity. In this Modigliani-Miller ideal world, an optimal debt-to-equity ratio does not exist and managers ought to spend their time looking for value adding investment opportunities without consideration of financing alternatives.

MMI also leads to a second proposition, generally referred to as MM Proposition II. MMII states that a mathematically defined linear relationship exists between the debt-to-equity ratio and the levered cost of equity. As the company takes on more debt, it becomes more risky, but the effect of adding "cheaper" debt is exactly offset by having less, although now "more expensive," equity. If this were not the case, arbitrage would be imperfect and leverage would matter. These two MM propositions serve in most textbooks as the foundation for discussions of capital structure decisions faced by managers.

Although Modigliani-Miller show a linear relationship between the cost of equity and the debt-to-equity ratio, student understanding of leverage likely occurs in debt-to-value space. Further, many of the textbook discussions of follow-on capital structure topics theories are presented in debt-to-value space[3]. Finally, the concept of leverage in debt-to-value space is generally consistent with discussions of leverage in the popular press. So care must be taken in presentation of the MM concepts of the existence of the two measures of leverage. A related issue is that graphical representation of the MM concepts are often presented without fully identifying or scaling either or both axes[4], obscuring (i) the decidedly different relationships between the cost of equity and the two measures of leverage and also (ii) the extreme rise of the cost of equity as leverage increases.

This paper is a teaching note that seeks to aid instructors in enhancing student learning of the 1958 MMI and MMII propositions and, as a result, to better prepare students to transition their understanding from the Modigliani-Miller "perfect world" concepts to financial markets where frictions exist. We begin by discussing two different measures of leverage and present an exercise to underscore their differences. We next present several exercises utilizing the two measures of leverage that are designed to emphasize the understandings that the instructor may wish students to draw from the MMI and MMII propositions. In the last section, we provide concluding thoughts.

TEACHING THE MEASURES OF LEVERAGE

Textbooks do not always define the measure of leverage being used, or may have defined it in an earlier section or chapter. Sometimes the measure is switched within or between sections or chapters and with little or no notice. Graphing based on the debt-to-equity ratio and the debt ratio represent the same in that they are both accurate to the MM theory, but understanding the difference between the measures and being aware of which is used in a textbook at any particular point is critical to students understanding the discussions and graphs presented. Our experience suggests that students will not recognize these issues or think them through on their own. It then becomes critical for those of us teaching the theories and concepts of capital structure to start by ensuring that students are aware that there are different measures of leverage and that they understand what each one represents. In addition, students need to be able to recognize which of the measures their textbooks use for each discussion and graph presented. So we start by defining the measures of leverage most commonly used.

The introduction to this paper mentions two basic measures of leverage. The first is the debt-to-equity ratio (D/E), where D is defined as the market value of the company's debt and E is defined as the market value of the company's equity such that D+E is the market value of the company. The second measure of leverage is the debt ratio, also known as the percent of debt (financing, used), % leverage, debt-to-assets (D/A), and others too. The debt ratio is equal to D/V, where D is again defined as the market value of the company's debt and V is defined as the market value of the company (D+E), and the ratio is usually expressed as a percent (%).

Once students have developed an understanding of the commonly used measures of leverage, instructors could have students work an exercise, as developed below (Table 1), comparing changes in the D/E and in the debt ratio as leverage is increased. Such an exercise would help students to develop an understanding of the differences in the measures that is crucial for truly understanding the textbook presentations of the Modigliani-Miller model. Likewise, this understanding is crucial as students seek to understand capital structure in a world of frictions.

To illustrate the importance of the comparison, a worthwhile exercise is to ask students to identify the point on a simple graph, such as Figure 2A below, where the company is half financed by debt and half financed by equity. The range of the x-axis (D/E) could be from 0 to 9, 20, or even 40. Our experience is that, without working through an exercise such as the one below, the majority of students choose the midpoint–a D/E of 4.5, 10, or 20, respectively. Yet these three points actually represent about 82% debt, 91% debt, and 95% debt, respectively, with none being anywhere close to 50% debt. The students are thinking in terms of % debt, not D/E. Indeed, we find that our colleagues will often make the same choice as the students. Exercise 1 allows students to develop the correct answer that a D/E of 1.0 is equivalent to a 50% debt ratio and begin to see that the representation of capital structure concepts will look radically different depending on the measure of leverage used.

Table 1: Exercise 1 -- Comparing Leverage Changes on the D/E and the Debt Ratio

Market Value Debt	Market Value Equity	D/E	Debt Ratio
0	200	0	0%
20	180	0.11	10%
40	160	0.25	20%
60	140	0.43	30%
80	120	0.67	40%
100	100	1	50%
120	80	1.5	60%
140	60	2.33	70%
160	40	4	80%
180	20	9	90%
190	10	19	95%
195	5	39	98%
200	0	Undefined	100%

For students to complete Exercise 1, they will need reference market values for the firm and either the equity or debt and to be reminded that the total market value of the firm equals the total market value of the debt and the equity. Another key piece of information for the students is that (consistent with the Modigliani-Miller propositions presented below) the total value of the firm remains constant. Exercise 1 above assumes that the total market value of the company is 200.

The completed exercise shows that the two leverage measures have noticeably different values and that they are not scale comparable. (Also, note that 100% debt financing is not defined for D/E, or is a D/E of infinity.) To further illustrate these concepts, students could create graphs of the relationships depicted in Exercise 1 or simply be shown graphs of the D/E and debt ratios as a function of the amount of debt. These graphs are shown below[5]:

Figure 1A: D/E as a Function of Leverage

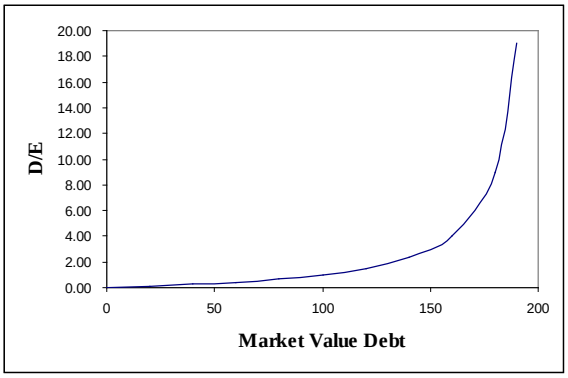
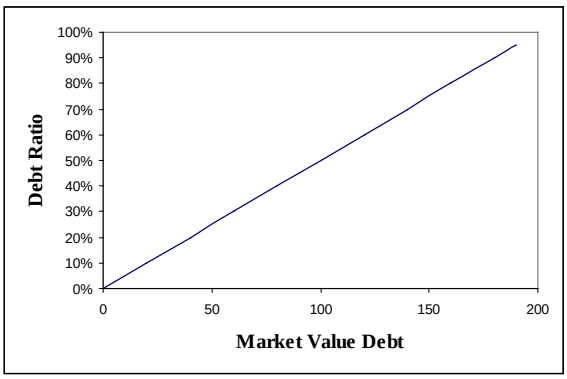


Figure 1B: Debt Ratio as a Function of Leverage



TEACHING THE 1958 MODIGLIANI-MILLER MODEL

Once the students have come to terms with the measures of leverage, they are ready to move on to the 1958 Modigliani-Miller propositions. MMI says that the value of a company is independent of its leverage and equal to its expected (constant) EBIT capitalized at a constant risk-adjusted discount rate. That is, the value of the company is a function of the earnings power of its assets and its risk-class, not of its level of debt financing. MMI also implies that a company's cost of capital is constant across various levels of leverage and is equal to its unlevered cost of equity. This relationship is shown in Equation 1:

$$VL = VU = EBIT/WACC = EBIT/keU \quad (1)$$

VL is the value of the levered company
VU is the value of the unlevered company
EBIT is the company's (expected, constant, and into perpetuity) earnings before interest and taxes
WACC is the company's average cost of capital
keU is the company's unlevered cost of equity

Having the students graph MMI first using D/E on the x-axis and then using the debt ratio on the x-axis effectively results in the same graph. Assuming expected EBIT is a constant 20 into perpetuity and the WACC, which equals the company's unlevered cost of equity, is 10%, VL = VU = 20/0.10 = 200. Both graphs below clearly show that there is no optimal capital structure and that the value of the company is independent of its capital structure.

Figure 2A: MM Proposition I: D/E Space

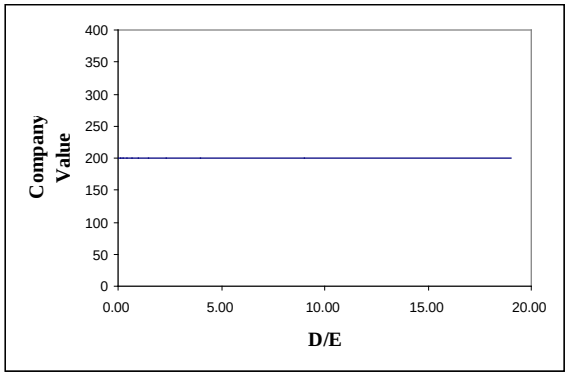
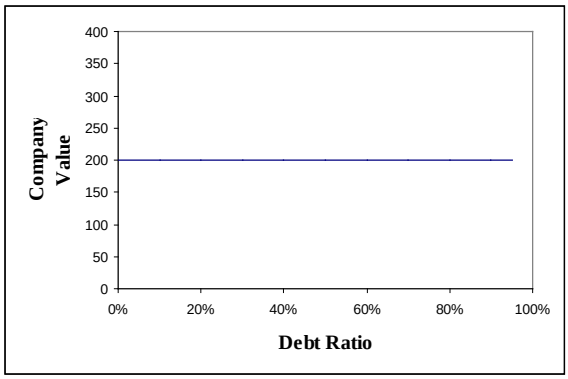


Figure 2B: MM Proposition I: Debt Ratio Space



The second MM proposition follows from the first and states that a linear relationship exists between D/E and the levered cost of equity. As the amount of debt financing increases, the cost of equity also increases, and does so in a specifically defined manner. This relationship is shown in Equation 2:

$$keL = keU + (keU - kd)*D/E \quad (2)$$

keL is the company's levered cost of equity
keU is the company's unlevered cost of equity
kd is the constant cost of debt
D is the market value of the company's debt and E is the market value of the company's equity such that D+E is the market value of the company

Taken together, the two MM propositions imply that as the company issues more debt, risk increases for the equity stakeholder, the cost of equity increases, and the benefits of the "cheaper" debt exactly offset the increase in equity risk. Although the cost of equity has increased, the amount of the company financed by this "higher cost" equity is less. The net result is a constant company average cost of capital that is equal to the company's unlevered cost of equity. This trade-off or rebalancing may not be obvious to students and the instructor may find it desirable to use Equation 3 to show this relationship:

$$WACC = kd * (D/V) + keL * (E/V) \quad (3)$$

WACC is the company's average cost of capital
kd is the constant cost of debt
keL is the company's levered cost of equity
D is the market value of the company's debt and E is the market value of the company's equity such that D+E is the market value of the company

When graphing the MMII relationships, it now matters which measure of leverage is used as a second set of graphs will show. First, however, students should be asked to work Exercise 2 below to understand (i) the levered cost of equity as a function of D/E (Equation 2) and (ii) the WACC (Equation 3). We again assume expected EBIT is a constant 20 into perpetuity and that the market value of the firm is 200. Columns 1 through 4 are as in Exercise 1. In order to work Exercise 2, students also need to be given a cost of debt, which is constant in the Modigliani-Miller world. For this exercise we assume a 6% cost of debt. The critical calculation for the students is the cost of equity in column 6, calculated using Equation 2. Because the value of the WACC is constant in this case, students may be tempted to simply fill out the value of 10%. Instructors, however, may want students to calculate each WACC using Equation 3 for learning purposes.

Table 2: Exercise 2 -- MM II: Cost of Equity and WACC

Market Value Debt	Market Value Equity	D/E	Debt Ratio	Cost of Debt	Cost of Equity	WACC
0	200	0	0%	6%	10.00%	10.00%
20	180	0.11	10%	6%	10.40%	10.00%
40	160	0.25	20%	6%	11.00%	10.00%
60	140	0.43	30%	6%	11.70%	10.00%
80	120	0.67	40%	6%	12.70%	10.00%
100	100	1	50%	6%	14.00%	10.00%
120	80	1.5	60%	6%	16.00%	10.00%
140	60	2.33	70%	6%	19.30%	10.00%
160	40	4	80%	6%	26.00%	10.00%
180	20	9	90%	6%	46.00%	10.00%
190	10	19	95%	6%	86.00%	10.00%
195	5	39	98%	6%	166.00%	10.00%
200	0	Undef.	100%	6%	Undef.	Undef.

Once Exercise 2 is completed, students can then graph the cost of debt, WACC, and cost of equity, first, using D/E on the x-axis and, second, using the debt ratio on the x-axis. This will allow the students to visualize the stark differences in the appearance of changes to the cost of equity in D/E versus debt ratio space. The results are shown in Graphs 2C and 2D.

Figure 2C: MM Proposition II: D/E Space

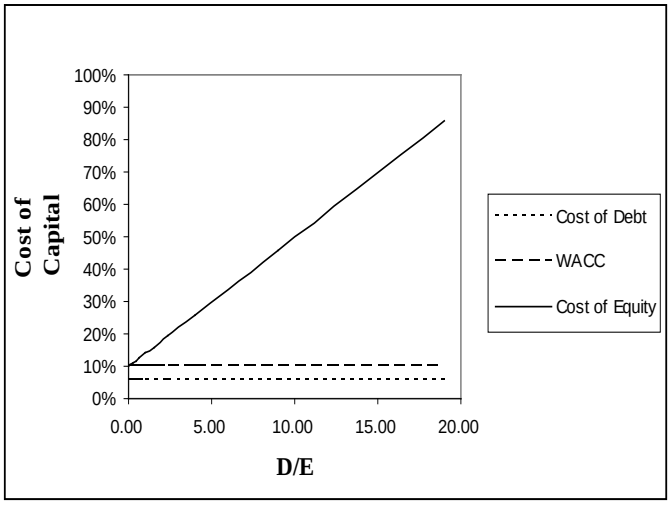
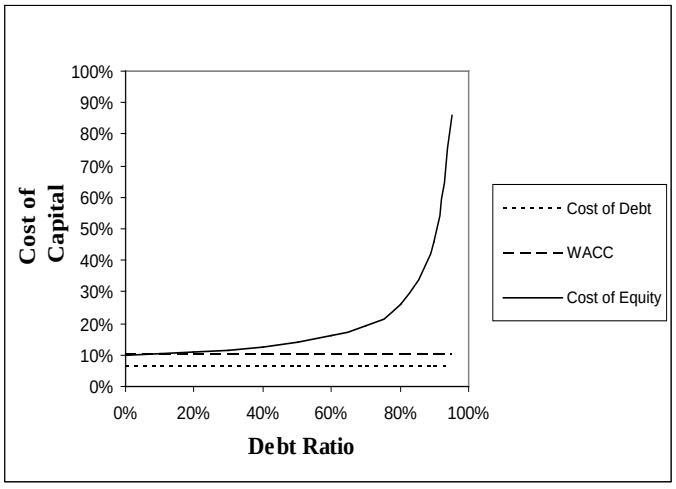


Figure 2D: MM Proposition II: Debt Ratio Space



Although the cost of debt and the WACC lines are the same in the new graphs, the cost of equity lines are dramatically different. When the x-axis is D/E, the cost of equity line is a straight line. This is expected and due to the second MM proposition: a linear relationship exists between D/E and the levered cost of equity (Equation 2). However, when the x-axis is the debt ratio, the cost of equity line is an upward sloping curve that, here, starts seriously increasing at around 50% debt. The change in the cost of equity due to increasing debt is exponential, not linear, when assuming a constant cost of debt and company average cost of capital.

As previously mentioned, students looking at the D/E graph but thinking of leverage in debt ratio terms are likely not

to recognize the point where the company is half financed by debt and half financed by equity. Referring to the D/E graph above (Graph 2C), because the range of the x-axis is from 0 D/E to 20 D/E, students most likely will identify 50% debt with a D/E of 10, which is the midpoint of the x-axis. However, a D/E of 10 is equivalent to about 91% debt. Obviously, students will easily recognize the 50% debt point when the x-axis is the debt ratio (Graph 2D).

At this point, instructors may want to point out the severe degree of compression when the x-axis is D/E. A 50% debt ratio is a little shy of half way between 0% debt and 95% debt and is equivalent to a D/E of 1. Yet, using a range of 0 to 20, a D/E of 1 is close to the origin and only covers 5% of the total x-axis range. Similarly, using a range of 0 to 20, a D/E of 10 is the midpoint and covers 50% of the total x-axis range yet represents about a 91% debt ratio. Students will need to be guided through this phenomenon in order to truly understand the scales of the two leverage measures and how dramatically different they are. A table of equivalents surely helps, but "seeing" it on the graphs will make it real.

What can complicate student learning further is when a textbook graph does not provide scaling for the x-axis. That is, when the far right-end of the x-axis is not delineated. In that case, is the range 0 D/E to 1 D/E? 0 D/E to 20 D/E? 0 D/E to 40 D/E? Alternately, is the range 0% debt to 50% debt? 0% debt to 95% debt? 0% debt to 100% debt? The far right end point surely makes a difference when interpreting the graph. Without a far right end point or assuming a full range (0 D/E to say 40 D/E, 0% debt to 100% debt), the student cannot know what degree of leverage the graph represents. Especially when the line graphed is curved, there is no way for the student to know at what point the curve starts to noticeably increase.

Students looking at the D/E graph but thinking of leverage in debt ratio terms also are likely not to understand the effect of adding (excessive) debt on the cost of equity and, worst case, may even assume the effect is a linear, marginal, possibly even negligible, increase in the cost of equity. The debt ratio graph shows that this is plainly not the case and the instructor may want to emphasize this point. In addition, lack of scaling of the y-axis can obscure this result and hinder student understanding. The instructor may use Graph 2D to show the theoretical nature of the Modigliani-Miller results, including the dramatic increase in the cost of equity, and to begin the process of introducing "real world" considerations. Students could be asked to consider the likelihood that equity investors would actually expect a return of 166%, 86% or even 46%, and, if so, what type of market situation does this entail? Are securities likely to be priced to earn 166%? Under what conditions would a firm increase leverage to the point that equity investors would require a return of 166%? What type of job security would a CFO expect if (s)he undertook such a policy? Hopefully, students in upper division courses would find this behavior extremely unlikely!

TEACHING EXTENTIONS TO THE 1958 MM PROPOSITI0NS

Once the MM "no taxes" propositions have been presented, most textbooks start transitioning to a more "real world" of frictions by relaxing various assumptions. Often the first is to include corporate (only) taxes (i.e., MM 1963 "with taxes"). Without presenting details, we note that the exercises presented above can be expanded and adjusted accordingly and parallel sets of graphs created. All implications derived from the MM "no taxes" continue (e.g., measure of leverage used, axis scaling and compression) but now the graphs themselves will change shape as well, leading to changed or additional implications for the value of the firm or its costs of capital. For example, when allowing for corporate (only) taxes, the cost of debt is still constant but is lower, the cost of equity, at some debt ratio, still noticeably increases but does so at a slower rate, and the WACC is no longer constant but decreases in a linear fashion.

SUMMARY

Our goal in this teaching note was to provide instructors with a series of exercises that could be used to enhance student learning of the 1958 MM propositions and better prepare students for transitioning their understanding from the Modigliani-Miller "perfect world" concepts to financial markets where frictions exist. We have suggested that textbook presentations of the 1958 Modigliani-Miller model allow for confusion on the part of students because of ambiguity in discussions and graphical representations. Textbook discussions of capital structure theories may be presented using different measures of leverage. Students looking at a graph in D/E space but thinking of leverage in debt ratio space are likely not to recognize the point where the company is half financed by debt and half financed by equity. The severe degree of compression when the x-axis is D/E adds to their possible misunderstanding. Students also are likely not to understand the effect of adding (excessive) debt on the cost of equity and, may incorrectly assume the effect is a linear, marginal, possibly even negligible, increase in the cost of equity. Additionally, the full implications of the propositions cannot be seen when the supporting graphs do not provide complete scaling for either or both axes. Furthermore, these issues remain when presenting the effects of relaxing one or more of the "perfect world" assumptions.

Finally, a note of caution. Textbook discussions and graphs, as well as the exercises and graphs presented here, are general representations and no one graph will represent all firms. Referring to the MMII graph when the x-axis is the debt ratio (Graph 2D), the cost of equity line is an upward sloping curve that starts seriously increasing at around 50% debt. This is true for our example and may be true for some companies but most likely will not be true for many companies. Students would greatly benefit from more discussion about industries and companies having different acceptable ranges of leverage and why this is so. Not having this finishing discussion may leave students with a naive, black-white type perception and not yet ready to contribute credibly upon entering the workforce.

The authors wish to express their gratitude to the participants of the February 2010 Academy of Economics and Finance Annual Meeting and especially discussant David Lange.

END NOTES

1. A perfect world is one in which the typical perfect capital markets assumptions hold: homogeneous and perfect expectations, no taxes, no bankruptcy, no transaction costs, all participants have the same information and can borrow and lend at the same constant cost of debt.

2. In his 1938 book, *The Theory of Investment Value*, John Burr Williams also presented the idea that the value of a firm is independent of its capital structure. (North Holland Publishing, 1938; reprinted by Fraser Publishing, 1977)
3,4. The results of a brief textbook survey are available at www.jfcr.org in the downloads section for JITF.
5. In order to be able to more easily compare the graphs in this paper, and for purposes of consistency, graphs where an axis is in D/E space have a range from 0 D/E to about 20 D/E and graphs where an axis is in debt ratio space have a range from 0% debt to about 95% debt. Since a D/E of 20 is approximately equivalent to a 95% debt ratio, all graphs represent approximately the same range of leverage.

Exhibit 1: Selected Franco Modigliani and Merton H. Miller Papers

1958 The Cost of Capital, Corporation Finance and the Theory of Investment
American Economic Review, 48, 261-297.
1959 The Cost of Capital, Corporation Finance and the Theory of Investment: Reply
American Economic Review, 49, 655-669.
1963 Taxes and the Cost of Capital: A Correction
American Economic Review, 53, 433-443.
1965 The Cost of Capital, Corporation Finance and the Theory of Investment: Reply
American Economic Review, 55, 524-527.
A paper by Merton H. Miller.
1988 The Modigliani-Miller Propositions After Thirty Years
Journal of Economic Perspectives, 2 (4), 99-120.

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A Quick Note from the Editor

It has been a pleasure to serve as the editor of the Journal *of Instructional Techniques in Finance* for the past two years. During this past year, we have made arrangements for Steve Johnson from Sam Houston State University to take over as editor. Steve has been a past contributor to the *JITF*, and we are looking forward to his leadership in taking the *Journal* forward. Please be patient with us as we accomplish the transition.

Please consider sharing your techniques for effective teaching of finance with us and those who receive the *JITF*. Our goal is to augment the effectiveness with which finance educators impart knowledge to their students. Those interested in becoming a participant in our mission should contact Steve at sjj008@shsu.edu. I will remain as an Executive Editor to provide oversight. Any concerns in that regard may be addressed to me at rstretcher@shsu.edu. Thank you for your interest in finance education!

Robert Stretcher

Journal of Instructional Techniques in Finance
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