ADVANCES IN FINANCIAL EDUCATION

WINTER 2016

Financial Education Association

The Journal Staff

ADVANCES IN FINANCIAL EDUCATION

Winter 2016

Financial Education Association

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The Business of Education: Using Project Based Learning in Finance Courses

Mary C. Funck*
The Department of General Business and Finance
Sam Houston State University

Rebecca A. Wentworth
Department of Curriculum and Instruction
Sam Houston State University

D. Patrick Saxon
Department of Educational Leadership
Sam Houston State University

Given today's larger and more culturally diverse college student population, college faculty may consider students to be underprepared for the rigors of higher education. Educational literature suggests that conventional models of teaching do not engage current students as successfully as with their historic peers. This article describes how Project Based Learning (PBL) can be incorporated into a foundational corporate finance course in an effort to better meet the needs of today's diverse learners. The components of PBL are described and examples of implementation are included. Anecdotal evidence is provided that students who are exposed to innovative hands-on pedagogical methods are more engaged and perform at least as well on concept attainment as students taught by traditional lecture methods.

INTRODUCTION

A common discussion amongst finance faculty revolves around the challenges and frustrations of teaching relatively complex finance skills to today's college students. Faculty members often view current students as "hopelessly underprepared or less bright or motivated than previous generations" (Schroeder, 1993, p. 22). Perhaps though it is not student capability and enthusiasm that have waned; difficulties in the classroom may be attributed instead to a substantial disconnect between the traditional content-focused teaching style of educators and

* *Contact Author: Box 2096, Department of General Business and Finance, Sam Houston State University, mcf012@shsu.edu,*

the learning needs of current students. The research project described here, which involves implementing innovative student-centered pedagogy, demonstrates one method of overcoming the gap between instructors and students that seems pervasive in college classrooms today.

TODAY'S LEARNERS

Today's college student population is larger and more diverse racially and ethnically than ever before. More traditionally underrepresented groups of students are now attending college (Renn & Reason, 2012), and national statistics show that approximately 50 percent of college undergraduates are first generation students (U.S. Department of Education, 2010). A significant percentage of entering students exhibit low levels of academic and college preparedness (NCES, 2003). These students are often socioeconomically challenged and tend to lack the skills needed to successfully navigate the college environment. As a result, they may have difficulty transitioning to college and are less likely to engage in behaviors that contribute to their academic success (Hirudayaraj, 2012).

Not only are college students drawn from a different demographic than in the past, they also seem to learn differently. Schroeder (1993) uses the Myers-Briggs Type Indicator (MBTI) to better understand the learning styles of contemporary students.[1] His research finds an increasing representation of 'sensing learners' in college classrooms. These individuals are characterized by a preference for concrete experiences and highly structured learning, and they require more justification than their predecessors for performing academic tasks. Schroeder explains that sensing learners benefit from a 'practice to theory' mode of instruction. He purports that active forms of teaching, such as team projects and case studies, provide experiential learning for these classroom participants and appear to be effective in increasing student engagement and subsequent learning.

Kolb and Kolb (2005) further describe the variety of learning preferences present in today's classroom; they recommend that instructors offer opportunities for multiple means of engagement in order to promote contextual and transformative learning. Boylan (2002) suggests, particularly for academically underprepared college students, that instructors utilize a diverse array of instructional techniques. He supports using hands-on learning methods, self-paced and individualized instruction, and collaborative learning with peer review.

The diversity in the learning styles of today's college students, however, is often not addressed by methods used in conventional college education. In a recent metaanalysis of classroom observation studies conducted by Freemen et al. (2014),

[1]The MBIT is a survey instrument that attempts to explain the role of individual differences in learning. It is based on four dimensions: the degree of introversion versus extroversion and sensing versus intuition.

lecture, the predominant form of instruction used by college professors, was found to be less effective than active learning methodologies. Additionally, Lambert (2012) states that "interactive learning triples students' gains in knowledge as measured by . . . conceptual tests" (para. 9). Research also suggests that contemporary students are intimidated by the large lecture-style settings often found in traditional college classes (Thomas & Quinn, 2007). The discrepancy between student needs and instructor methodology has the potential to disenfranchise today's students, leading to disengagement and academic failure.

PROJECT BASED LEARNING

The primary objective of this research is to improve financial education for undergraduate business students by modifying our teaching approach so that we better address the learning needs of the current student population. To attain this goal, we considered models of teaching that have been shown to motivate learners to develop higher-level critical thinking skills, incorporate real-world application of classroom content, and engage learners in the use of the 21st century skills that are needed in today's business work force. We were specifically searching for a technique that preserves our current course content and that continues to provide the capability to assess students individually on the skills and knowledge necessary not only in subsequent finance courses, but by students in their career paths as well. The quest for such a teaching approach led us to project-based learning (PBL), a technique in which (a) the core concepts of a class are presented to students within the scope of an overarching project; (b) students use a project-based approach to explore and address real-world problems and challenges; and (c) the project culminates in the production of a deliverable product and presentation for an authentic audience.

The academic community provides justification for using a project-based approach to teach finance. Vihtelic (1996) examines the role of the personal finance class in finance education and states that the, "Emphasis on student experiences rather than teacher authority can be viewed as the critical factor in achieving true understanding" (p. 123). The Association to Advance Collegiate Schools of Business (AACSB), the foremost accrediting agency for business education programs, has established learning and teaching accreditation standards to promote excellence in business education. Offering support for our venture, the AACSB (2013) states that business curricula should "facilitate and encourage active student engagement in learning" (para. 2). These standards identify project-based learning as an appropriate opportunity for students to engage in experiential and active learning designed to improve skills and the application of knowledge.

When first introduced to PBL as a model of teaching, it is easy for an instructor to think, 'I already use projects in my classes. How is this different?' There are several key differences between traditional content projects and project-based

learning. Most notable among these differences is that in PBL, the final product is not a class additive. Instead, it is introduced at the beginning of the course or unit of study and is pervasive throughout the entire curriculum. Reiteration of the semester-long project at key intervals provides academic motivation for students who otherwise may not see the connections between content and the world of work. Because of PBL's emphasis on the project and its incorporation into course content, the project cannot be eliminated due to lack of time. With the traditional additive approach, instructors who fall behind in delivering content may choose to eliminate the final project due to time constraints.

ACADEMIC CONTEXT

The foundational corporate finance course was selected as the class in which we applied PBL – transitioning the pedagogy from teacher centered to student centered. At our university, this course is required for all business majors and minors, is customarily taken during a student's junior year, and is normally a student's first exposure to the principles of corporate finance. Enrollment in this face-to-face course is typically 40-45 students per section, and the course is taught in a traditional classroom rather than in a lecture-hall setting. Specifics regarding course content will be discussed later, but in general topics taught include corporate structure and governance, financial statement analysis and ratios, time value of money principles, capital components, and capital budgeting.

METHODS AND DISCUSSION

The Buck Institute for Education (http://bie.org/), a nationally-recognized leader in education research, has developed a set of key components which govern the implementation of project-based learning in the classroom. Our PBL teaching model incorporates seven of these components (shown in Figure 1). These components serve as a foundation on which we developed a four-stage model consisting of: (1) providing an entry event with the driving questions that will facilitate in-depth inquiry; (2) presenting the core content (knowledge) and building the 21st century skills needed to address the driving questions; (3) creating and revising deliverable products that meet the needs of the audience concerned with the driving questions; and (4) developing and presenting a final product, which allows for voice and choice in several dimensions, to an authentic audience. When designing the project parameters and academic experiences, we were committed to addressing a variety of learners and learning styles while maintaining accountability to high academic standards for all students.[2]

[2] Each of the seven key components of PBL is discussed in the context of the paper rather than in a dedicated section.

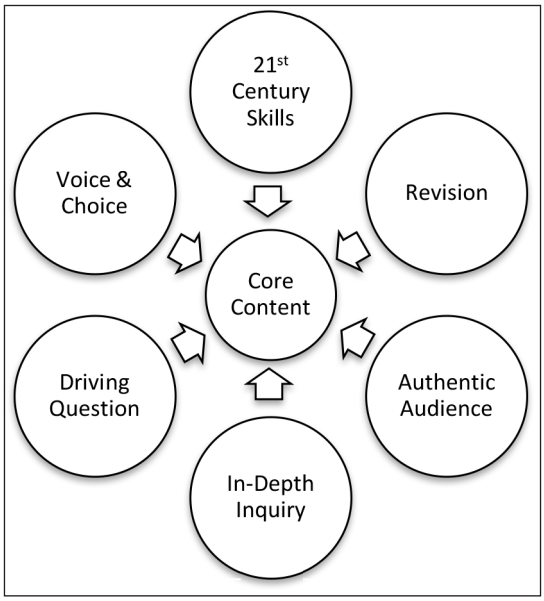

Figure 1. Seven Key Components of Project Based Learning

Stage 1: Entry Event and Driving Questions

An entry event for PBL consists of an organizing experience that provides context for the unit of study and presents students with the concept, although not the specifics, of the final project. The entry event provides enough detail to engage students' interest while challenging them to question their present ability to respond adequately to a proposed task or scenario. This event should pique student interest in moving forward with the course work while providing for them a schema within which to seat their learning. The entry event can take any form that conveys information about the direction in which final student projects will proceed.

The entry event for this finance course consists of a mock videoconference with the Chief Financial Officer (CFO) of a corporation; the CFO outlines the need for students, in the role of financial analysts, to find ways to improve the corporation's profitability by evaluating potential investment opportunities. (Refer to Appendix A for a script of the entry event video.) This video provides the question that drives the semester's content: "How do we evaluate opportunities to maximize shareholder wealth?"

After watching the video, students are placed into 3-4 member groups and instructed for homework to brainstorm skills or knowledge that may be necessary to meet the proposed challenge. Once groups have submitted their contributions digitally, the instructor facilitates an in-class discussion that serves to compile data

from small group submissions into a comprehensive Need to Know Board for the class as a whole (refer to Figure 2). Access to this Need to Know Board is given to students throughout the semester, allowing them to analyze the key units of learning they have mastered and to identify those skills they have yet to obtain. Students are also encouraged to update the Need to Know Board if requisite skills were omitted when the board was initially created. (Note that although this Need to Know Board can be created with more traditional tools such as chalkboard or flipchart while in class, we used a course management system and had students brainstorm digitally outside of class. This allowed time for subsequent in-class discussion of the proposed concepts.)

Stage 2: Core Content and 21st Century Skills

Using the Need to Know Board and building on in-class discussion, the instructor organizes a Knowledge and Skills Outline (see Figure 3). This process validates the students' ability to identify key pieces of information they will be learning throughout the semester, providing a bridge from their prior knowledge to their proposed learning, which, according to educational research (Kendeou & van den Broek, 2007), helps strengthen a student's ability to learn and retain new knowledge. Additionally, students are able to see how individual skills unite to create a cohesive whole, informing the answer to the driving question of "How do we evaluate opportunities to maximize shareholder wealth?" This validation further serves to motivate student effort and performance.

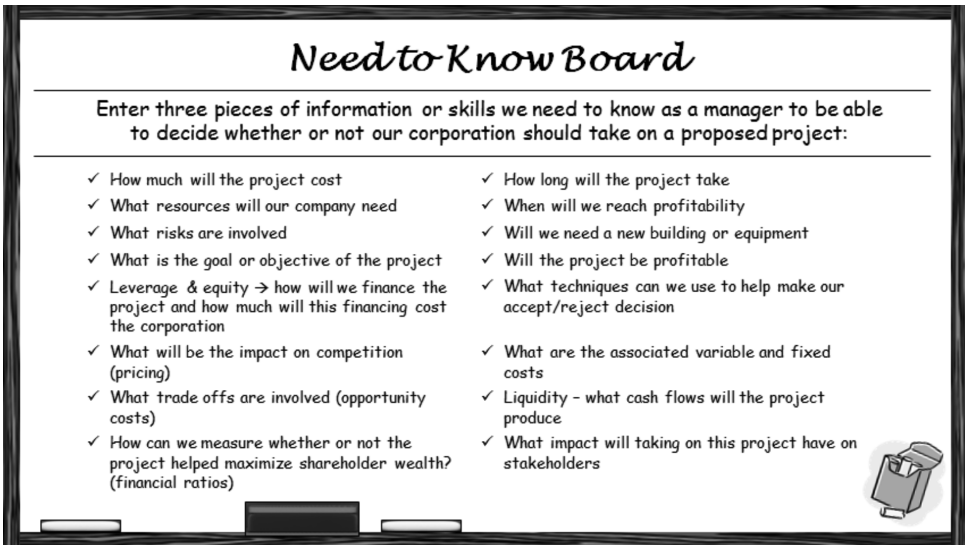

Figure 2. Need to Know Board.

Figure 3. Knowledge and Skills Outline.

How does taking on this project affect a corporation's financial performance and condition?

- Understand Financial Documents - Balance Sheet, Income Statement
- Calculate Financial Ratios
- *How does the corporation's performance and condition change if we take on this project? [Deliverable 1]*

How much will it cost for the corporation to raise the necessary capital (funding) to support planned investments?

- Calculate the costs associated with issuing debt
- *What factors impact the cost of debt capital? [Deliverable 2]*
- Calculate the costs associated with issuing shares of stock
- Determine how risk affects the cost of raising capital.
- *What factors impact the cost of equity capital? [Deliverable 3]*

Will taking on this project help a corporation meet its primary goal of maximizing shareholder wealth over the long run?

- Determine the overall cost of raising capital when both equity and debt financing are used.
- Apply techniques that allow us to compare the projected costs and cash flows for a project
- Calculate the estimated costs (-) and cash flows (+) for a project
- Incorporate forecast error into our project evaluation in case our estimations are incorrect
- *Should our company accept this investment opportunity? [Final Project Deliverable – Presentation]*

As mentioned above, PBL does not replace current teaching methods; instead, it repackages them under an organizational umbrella that provides students with a clearer understanding of how they will transfer the skills they learned in the classroom to the world of corporate finance. Working from the Knowledge and Skills Outline, the course instructor presents content lectures, in-class exercises, and assigned readings. Additionally, students are assigned homework problems, corresponding to each section of material, requiring students to practice and build on the knowledge learned in class. Quizzes and tests are also used as both formative and summative assessments to give feedback to students regarding their progress toward skill attainment and in part to determine semester grades.

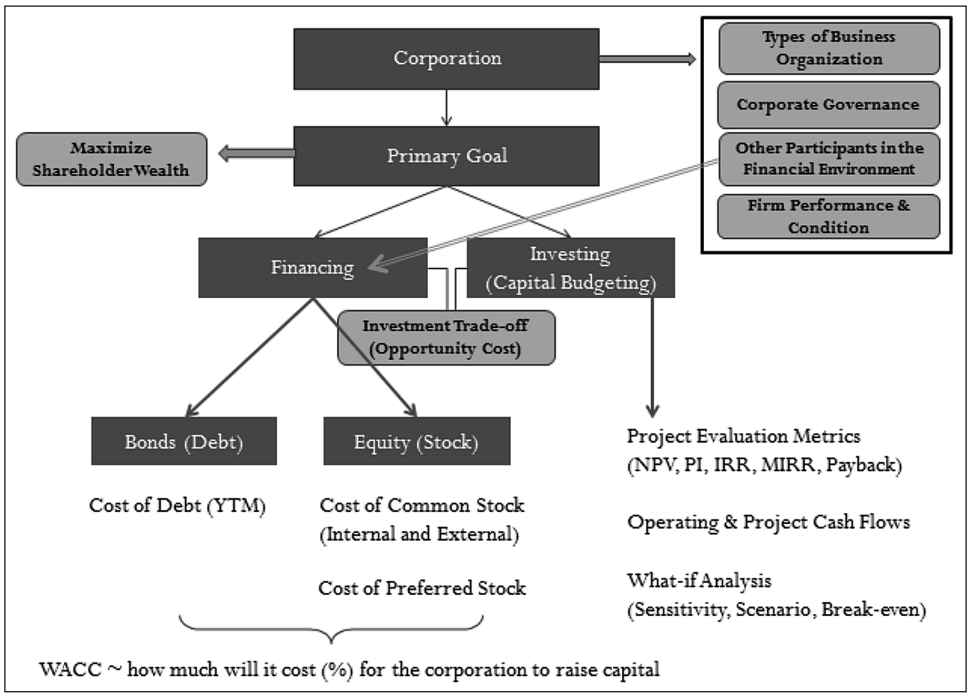

Figure 4. Course Concept Map.

To further assist students in organizing course content, a Concept Map is developed that visually depicts the relationship between separate units of study within the course (Figure 4). The introduction of each new major content area begins by revisiting the Concept Map, which illustrates to students how all content, both previously learned and what will be introduced in the upcoming section, relates to the overall knowledge schema. The Concept Map begins as a simple structure, but increases in detail as the semester progresses.

Stage 3: Intermediate Deliverable Products

At the completion of each major content area, an 'intermediate deliverable product' (deliverable) is completed by each group. (Figure 5, the Course Flow Chart, illustrates the iterative semester pattern.) In this finance course the deliverables are implemented in Excel using real-world data. These deliverables not only allow students to show mastery and application of concepts learned in the corresponding section of the course; they also incorporate practice of skills that will be necessary for completion of the final comprehensive project and presentation. (Refer to Figure 3 for placement of each deliverable in the course and the associated content.)

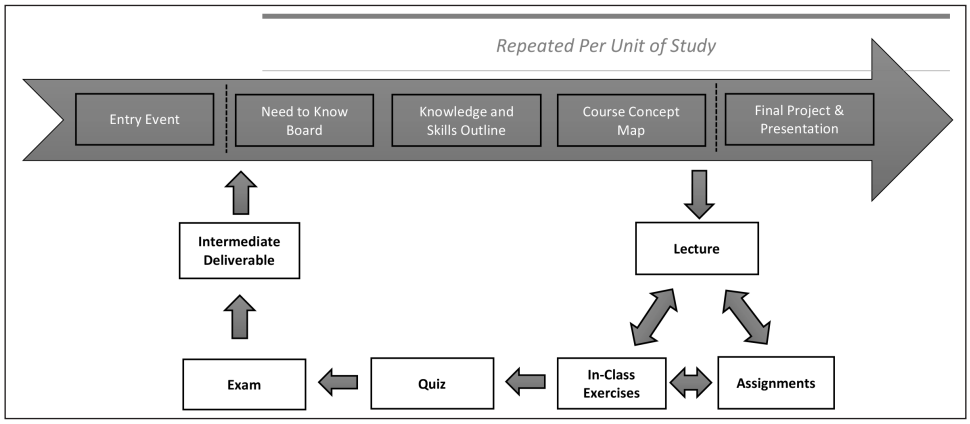

Figure 5. Course Flow Chart.

Note that Figure 5 shows that before students participate in deliverables development, they have participated in lectures, assignments, and in-class exercises designed to ensure student attainment of requisite skills. Use of Excel worksheets and functions is only available to students after assessment of skills has been administered.

Firm performance and condition. The first deliverable for this finance course centers on using financial statements and ratios. Using income statements and balance sheets available online for a designated real-world company, students input data and formulas into an Excel template to calculate financial ratios and conduct what-if analyses (refer to Appendix B). These analyses allow students to experience how action a firm undertakes, such as issuing additional debt, impacts firm performance and condition.

Cost of debt capital. Again using Internet-based real-world data from sites such as MorningStar.com, students locate data that describe the long-term debt issued by the designated corporation, and using Excel functions, calculate the price and yield to maturity of a corporate bond (refer to Appendix C). To demonstrate the inverse relationship between bond prices and yields/maturity, students solve for prices and yields in scenarios in which interest rates and length to maturity change.

Cost of equity capital. For the third intermediate deliverable, students download data (such as can be found on Finance.Yahoo.com) pertaining to the designated corporation, including the market price, dividend payout ratio, net income, equity beta, and the number of shares outstanding. Students also locate values for the return on the risk-free asset (Treasury bills) and a market portfolio proxy (market index). Employing these data values, students use Excel formulas to calculate the stocks' required rate of return (Capital Asset Pricing Model) and intrinsic value (Dividend Discount Model). Finally, students compound the current

dividend period by period for 120 periods into the future, discount the dividend stream using the required rate of return, and sum the present value of the dividends for comparison of the intrinsic value to the market price (refer to Appendix D).

Stage 4: Final Deliverable

Near the end of the semester, each student group is provided with a unique list of project inputs regarding a proposed investment opportunity a corporation has under consideration. Inputs include the initial cost of taking on the project (purchasing a building and equipment, and the necessary investment in net working capital), variable and fixed costs, depreciation rates, initial values for the number of units produced and sale price, annual growth rates for the number of units produced and sale price, end-of-project market value for the building and equipment, and the corporate tax rate. Information is also given concerning the corporation's long-term debt and common and preferred stock. Appendix E contains a sample of the input data provided to students.

A critical component of PBL is providing students with voice and choice. To incorporate this into our classroom, we ask students to create a company logo and product description. They also postulate company background and define the target market for the proposed product. We are always amazed at the level of creativity and the amount of thought students demonstrate when creating their 'companies' and 'products.' Appendix F contains a sample of the product/companies presented by students since we have integrated PBL into the introductory finance course.

Given the above described data, students use Excel to calculate the Weighted Average Cost of Capital (WACC), depreciation expenses and book and salvage value for the equipment and building, and annual operating and project cash flows. Students then evaluate the proposed project using the standard investment metrics: net present value (NPV), internal rate of return (IRR), modified internal rate of return (MIRR), profitability index (PI), payback period, and discounted payback period. To address possible forecast errors, students perform sensitivity, scenario, and accounting breakeven analyses (refer to Appendix G). Based on their evaluation, students are able to offer and justify a decision regarding whether the corporation should accept or reject the proposed investment opportunity, a decision based ultimately on the impact on shareholder wealth.

In an 8-12 minute presentation, each group shares their findings with an authentic audience composed of fellow students as well as faculty from the Department of General Business and Finance. Because of the public nature of the presentation, students are assessed not only on their content knowledge as illustrated in their presentation, but also on their professionalism as reflected in their dress, demeanor, and presentation materials.

ASSESSMENT

Assessment for this course merges traditional grading with project assessment. Students are held accountable for individual homework assignments, quizzes, and exams, which comprise 80 percent of the semester grade. The remaining 20 percent consists of scores earned on the intermediate and final project deliverables.

To hold all group members accountable for learning and participating in the group context, students are required to complete a peer evaluation in which they assess the performance of themselves and each group member. On a scale of 1 to 10, each student is rated on participation, communication, dependability, and contribution using the rubric-style assessment grid we developed. This rating is incorporated into and can significantly impact individual students' final project grade.

RESULTS AND DISCUSSION

Attempting to improve financial education for undergraduate business students, we modified our teaching approach in the fundamental corporate finance course. We were specifically looking for teaching methods that would better address the learning needs of the current student population, which research shows does not respond favorably to lecture-based and teacher-centered pedagogy.

Incorporating a PBL model allowed us to preserve course content while shifting the focus away from rote skill attainment towards the application of skills necessary to solve problems in real-world companies. Conversations with students reveal their appreciation of the approach as it provided an organizational schema for their learning, as well as hands-on experiences they may face in the world of corporate finance. One student reported, "I went to visit my father at his office last week and happened to look at the white board hanging in his office. He's doing all the same things at work that we are learning in the class project."

Before the implementation of PBL, students in this course reported having trouble connecting with the material. For example, in evaluation of this course, one student wrote, "You're a good professor; I wish there was . . . a different method for people like me to learn easier." Conversely, on the course evaluation during the first semester of PBL implementation, one student reported, "This project was great. I really have enjoyed putting my finance skills into a real scenario and to see how much I have really learned in this class. Overall great experience. I cannot wait to use financial analysis in real life!"

An additional benefit of PBL implementation is the intrinsic motivation to truly learn and retain material throughout the semester. Knowing the final project involves all content skills makes it necessary for students to preserve knowledge

learned early in the term for use at the semester's end. Students filling out course evaluations made comments such as, "I like the group project. I thought it was a good way to put it all together," and "Overall I really enjoyed the class. I learned a lot."

Another unexpected outcome from this project was the high level of creativity the groups exhibited in completion of their final deliverables. Although the curricula of finance courses naturally appeal to mathematical and analytical students, creative students may find the material less relevant. By asking each group to create an original company and product for sale that conformed to the data provided in their unique scenario, creative students found a niche for their area of interest, which supplied the requisite buy-in for deep and lasting learning. For example, one group recognized the low profitability of their project and designed an overly expensive 'pampered pet pillow', informing their judgment to reject the company's proposed project.

Integrating PBL methods into a course also brings with it an opportunity to incorporate 21st century skills with course content. In the world of corporate finance, students are headed from the college classroom into the business world where familiarity with electronic spreadsheets is expected. To this end, the project deliverables require that students advance their proficiency with Excel.

Finally, students showed outstanding confidence and enthusiasm in the presentation of their findings and recommendation. Previously when we observed students arriving at class for the comprehensive final exam, which has been replaced by the group project, we saw nervousness and dread on their faces. Arriving for their final presentations, by contrast, students were self-assured, dressed professionally, and eager to demonstrate their knowledge by showing off their product and making their final recommendation concerning the proposed product. Students were so excited for their turn at the podium that presentation order had to be decided by drawing because every group wanted to go first.

This confidence, we purport, was a reflection of their deep understanding of course concepts, their ability to apply financial skills learned in the classroom to simulated data, and to make choices for their 'shareholders' based on evaluation of capital-budgeting scenarios. Assessment data was collected from sections of the Business Finance course during three semesters (Fall 2012, Spring 2013, and Fall 2013) in which PBL was incorporated to an increasing degree (refer to Figure 6.). Students demonstrated substantial gains when assessed on equity pricing (34.43% correct in the fall 2012, to 41.86% correct in the spring 2013, then 66.33% correct in the fall 2013). Assessment on completing financial ratios and finding the present value of uneven cash flows also show a positive trend in student comprehension. Assessment data reveal, however, that student assessment of bond pricing first increased in the spring of 2103 followed by a significant decrease in fall 2013. This realization allowed us to take corrective action to modify our approach to teaching this material. Ultimately, coupling concept attainment with the option to create

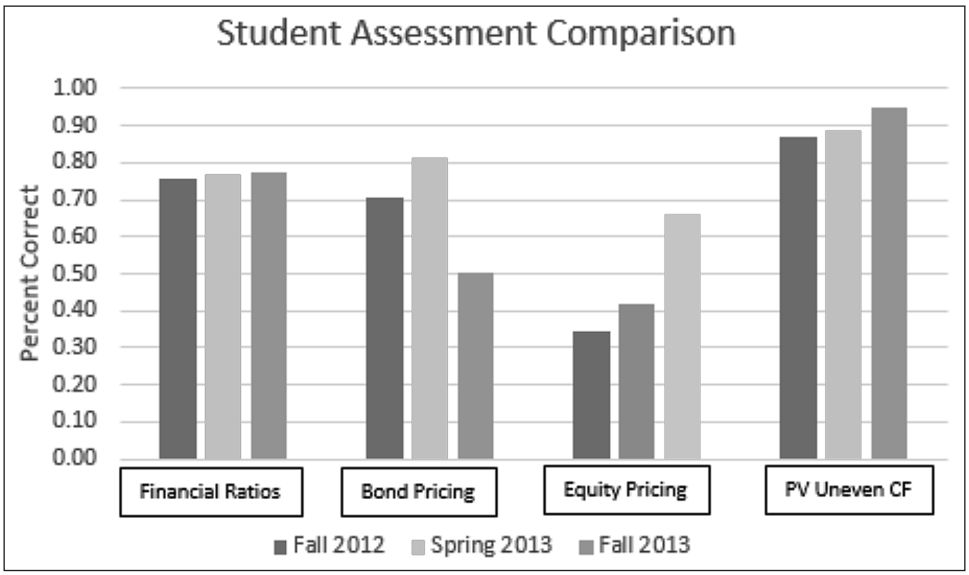

Figure 6. Student Assessment Comparison.

dynamic products and presentations, students are able to demonstrate content mastery on a much more sophisticated level than what is traditionally measured with a paper-based final exam. Even those students who were initially reluctant to accept a project in place of a final exam presented with authority and vigor.

PROPOSED MODIFICATIONS

A common concern regarding the implementation of a group project is group dynamics and governance. Conflicts can arise in any group context; add to that the high-stakes nature of grades that are part of the classroom context, and tensions between members can take on exaggerated importance. To address this, we implemented the peer evaluation grid discussed above. Additionally, we are considering the following alterations to the group process: (a) allowing self-forming groups; (b) incorporating group-composed governance documents; and (c) increased transparency of the group-grading process.

CONCLUSION

Transforming a classroom from traditional lecture to a more innovative project-based pedagogy takes significant time and effort. This approach requires that instructors design real-world projects that incorporate skills from throughout the curriculum, engage students in higher level critical thinking and problem solving behaviors, and maintain a high level of student interest over a 16-week semester.

Although it has not been perfect, we believe bringing PBL into this classroom was a positive step toward meeting our objective of improving finance education for our students. We will continue to use PBL and modify our implementation based on student feedback and success. Ultimately, we enjoy this new approach to teaching and the positive impact on student engagement in the classroom.

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Appendix A. Entry Event Video Script

Introduce yourself as CFO of our company.

Welcome students to the meeting – identify their position as junior financial analyst.

The reason for today's meeting is that our company is reviewing our capital budget, and we are considering several potential investment projects. Our company's profitability has not been as robust lately, and some of the more influential shareholders have been pressuring the board of directors to find profitable investments to increase the wealth of the company and the subsequent return to shareholders.

The task at hand is for each team of junior analysts to evaluate a potential investment opportunity to determine if our company should take on the proposed project.

Throughout the next several weeks, information will be delivered to help the team members gain the prerequisite skills for completing this project analysis. There will be three intermediate tasks for each team to complete that will be incorporated into the final analysis.

We will meet again at the end of the semester at which time each team will be given an opportunity to present their recommendation.

The team providing the most comprehensive analysis will receive a promotion, a corner office, AND a week's vacation to Huntsville, Texas (at their own expense).

Appendix B. Project Deliverable 1 – Firm Performance and Condition, Part I

Sector: Basic Materials
Industry: Major Integrated Oil & Gas
Company: Exxon Mobil (XOM)

FINANCIAL RATIOS

Statistic	Summer 2013	Fall 2013	Spring 2014	Summer 2014
Price	91.75	89.13	94.57	
Market Capitalization	407,960,000,000	392,430,000,000	430,340,000,000	
Market Price / Book Ratio	2.45	2.36	2.45	
Debt / Equity Ratio	7.75	11.28	12.13	
Earnings per share (EPS)	9.83	7.95	7.66	
Operating Margin	13.46%	12.16%	11.45%	
Profit Margin	10.86%	8.98%	8.60%	
Return on Assets (ROA)	10.17%	9.05%	8.33%	
Return on Equity (ROE)	28.26%	21.77%	20.19%	
Current Ratio	0.89	0.87	0.84	
Dividend Payout Ratio	23%	29%	31%	

Company: BP plc (BP)

Statistic	Summer 2013	Fall 2013	Spring 2014	Summer 2014
Price	43.1	42.04	47.42	
Market Capitalization	137,620,000,000	132,680,000,000	148,770,000,000	
Market Price / Book Ratio	1.07	1.03	1.14	
Debt / Equity Ratio	35.42	36.11	38.31	
Earnings per share (EPS)	7.1	8.23	7.67	
Operating Margin	3.67%	4.30%	3.79%	
Profit Margin	6.05%	7.01%	6.45%	
Return on Assets (ROA)	2.80%	3.36%	2.92%	
Return on Equity (ROE)	18.32%	21.79%	19.82%	
Current Ratio	1.38	1.39	1.42	
Dividend Payout Ratio	29%	26%	29%	

Questions here about ratios

1) BP's Spring 2014 profit margin is larger than its operating margin.
Explain why this is an unusual occurrence.

2) Using Summer 2014 Price and Market Capitalization values,
calculate (using a formula) Exxon Mobil's shares outstanding.
Exxon's 2014 shares outstanding =

3) Using Summer 2014 EPS and the number of shares outstanding,
calculate Exxon Mobil's net income.
Exxon's 2014 net income =

4) Both Exxon Mobil and BP have a Spring 2014 Debt/Equity ratio greater than 1.
Explain what this implies about the debt ratio for both of these
companies.

Extra Credit Using the Summer 2014 Debt/Equity ratio, calculate Exxon Mobil's 2014 debt ratio (show formulas)

Appendix B. Project Deliverable 1 – Firm Performance and Condition, Part II

Exxon Mobil (XOM)
Balance Sheet (Annual Data, in thousands $)

Period Ending	Dec 31, 2013	Dec 31, 2012
Assets		
Current Assets		
Cash And Cash Equivalents		
Short Term Investments		
Net Receivables		
Inventory		
Other Current Assets		
Total Current Assets		
Long Term Investments		
Property Plant and Equipment		
Other Assets		
Total Assets		
Number of shares outstanding (enter this number in thousands)		
Dividend Payout Ratio		
Liabilities		
Current Liabilities		
Accounts Payable		
Short/Current Long Term Debt		
Total Current Liabilities		
Long Term Debt		
Other Liabilities		
Deferred Long Term Liability Charges		
Minority Interest		
Total Long-Term Liabilities		
Total Liabilities		
Stockholders' Equity		
Common Stock		
Retained Earnings		
Treasury Stock		
Other Stockholder Equity		
Total Stockholder Equity		
Total Liabilities and Stockholder		

Exxon Mobil
Income Statement (Annual Data, in thousands $)

Period Ending	Dec 31, 2013
Income Before Tax	
Income Tax Expense	
Minority Interest	
Net Income	

2013 Ratios	
Total Debt Ratio	
Equity Ratio	
Debt / Equity Ratio	
Earnings per share (EPS)	
Dividends per share	
Return on Assets (ROA)	
Return on Equity (ROE)	
Current Ratio	
Equity Multiplier	

Appendix C. Project Deliverable II – Cost of Debt Capital

Bond Information for Chevron Corporation.

	Name	Maturity Date	Price (per $100)	Coupon %	Yield to Maturity %	**Bond Type**	**Bond Price**	**# Coupon Pmts to Maturity**
	Chevron Corp New 3.191%	6/24/2023						
	Chevron Corp New 1.104%	12/5/2017						
	Chevron Corp New 2.355%	12/5/2022						
	Chevron Corp New 1.718%	6/24/2018						
B.	Chevron Corp New 4.95%	3/3/2019						
A.	Chevron Corp New 2.427%	6/24/2020						
	Chevron Corp New 0.889%	6/24/2016						

1) Use TVM functions to verify that the information in the chart is correct (there may be slight rounding errors)

Remember to make necessary conversions for semi-annual payments

Bond A. Chevron 2.427% --> Find Price

FV	
N	
PMT	
I/Y	
PV =	

** Cells C25 and F25 MUST contain a function*

Bond B. Chevron 4.95% --> Find YTM

FV	
N	
PMT	
PV	
I/Y =	
YTM =	

2a) What is the new price if the YTM on the Bond A increases by 1%?

FV	
N	
PMT	
I/Y	
PV =	

New YTM

** The I/Y is the only input that changes from the original scenario*

** Cells C34 MUST contain a function*

2b) Did the bond price increase or decrease? Explain why.

For Bond A (**Assume the YTM remains unchanged from its original value**):

3a) Find the price of the bond one year from today.

FV	
N	
PMT	
I/Y	
PV =	

** N should change from the original scenario*

** Cells C46 MUST contain a function*

3b) Did the bond price increase or decrease? Explain why.

Insert **formulas** to show:

3c) What is the Bond A's capital gains yield? CGY =

3d) What is the Bond A's current yield (use the original bond price)? CY =

3e) What is the Bond A's YTM? YTM =

Appendix D. Project Deliverable III – Cost of Equity Capital

Chevron Corporation (CVX)

Assume:

Chevron has a constant dividend growth rate (g): 13.28%

1. Find the following information for Chevron through yahoo finance:
   - Price Today (P_0)
   - Dividend Payout Ratio
   - Net Income (most recent annual data - full $, not in 1000s)
   - Shares outstanding (full number - in billions)
   - Beta
2. Find the following information for T-bills:
   - Risk-free rate (T-bills) r_f
3. Find the following information for the S&P500 Index:
   - Return on the market (S&P 500) r_m
4. Calculate the following information for Chevron stock (using formulas or functions):
   - Dividends (Total Dollar Amount)
   - Current per share dividend (D_0)
   - D_1: $D_0 * (1 + g)$
   - Market Risk Premium (MRP): $r_m - r_f$
   - Required rate of return (r): $= r_f + (r_m - r_f) * \beta$
5. Answer the following questions:

a) Why is the required rate of return on Chevron stock larger than the required rate of return on the market?

b) The Dividend Growth Model (DGM) implements the theory that the _____ of a share of stock today is the _____ of all _____ (dividends).

c) In the DGM, why must the relationship r > g hold true?

6. Complete the following table

Period	Dividend	PV of Dividend
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
134		
135		
	Sum of PVs	
	Intrinsic Value P_0	

Appendix E. Sample Group Input Values for Final Project Deliverable

Background Information

Expenditures	$625,000	Feasibility Report (2013)

Projected Values

	11,500	Units sold during the first year
	1.5%	Annual growth rate in units sold
	$2,850	Original price per unit
	1.7%	Annual growth rate in unit price
	$12,500,000	Purchase new building (2014)
	23	Building year-life for depreciation
	$6,275,000	Equipment cost (2014)
	$4,525,000	Investment in working capital (2014) (recovered at end of project life - 2018)
	$1,950	Variable manufacturing costs per unit
	$5,595,000	Annual fixed costs
	36%	Marginal tax rate
At the end of the project (2018):	$5,250,000	building market value
	$2,125,000	market value of equipment

Cash flows occur at the end of each year - the first positive operating cash flows for this project would occur 12.31.2015. The project's estimated life would be four years. (2015 - 2018)

Real properties (buildings) are depreciated on a straight-line basis, but all other assets are depreciated over shorter periods and on an accelerated basis (MACRS), with high depreciation charges in the early years and less depreciation in the later years.

MACRS Schedule:

Year	1	2	3	4
Rate	20%	32%	19%	12%

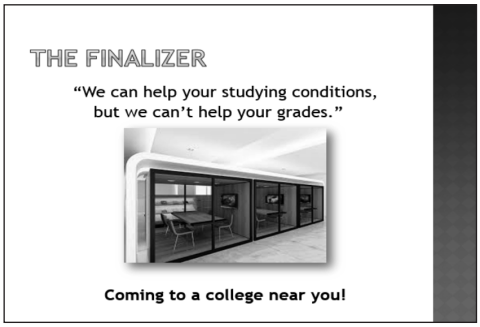
Expected WACC Information

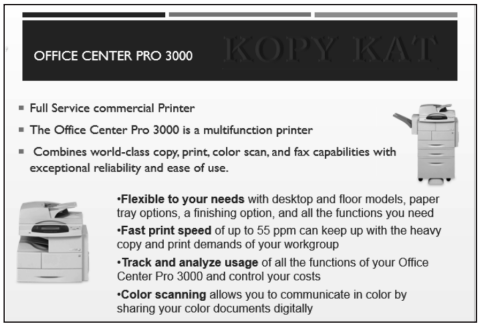
Bond mature in 9 years, pay a 11% coupon rate with coupons paid seminally, and sells for $1,045.00
Your company has 35 bond issues.

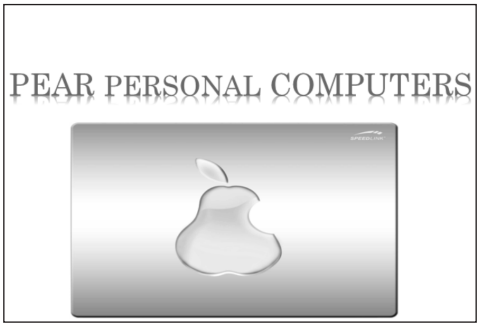
The return on the market is 11%, the risk-free rate is 4% and your company's beta is 1.3
Your company's common stock sells for $31.50 per share, and it has 2250 shares of CS outstanding

Preferred stock pays a dividend of $2.95 and currently sells for $26.85. Your company has 575 number of shares of PS outstanding

Appendix F. Selected Student Products







Appendix G. Final Project Deliverable – Capital Budgeting: WACC

Debt	Coupon Rate		
	Par Value		
	Years to maturity		
	Number of bonds		
	Price as percent of par value		
	Current Price		
	Total Value (# bonds * price per bond)		
	FV		
	PV		
	N		
	PMT		
	I/Y =		
	Cost of Debt (Annual YTM) r_d =		

Weights	Total Market Value of the Firm = Total Value of Debt + Total Value of CS + Total Value of PS		
	Total Market Value of the Firm =		
	Weight of Debt w_d = Value debt / value of the firm		
	Weight of CS w_c = value of common stock / value of the firm		
	Weight of PS w_p = value of preferred stock / value of the firm		

Common Sto	P_0	
	Beta	
	Market Premium	
	Risk-free Rate	
	Shares outstanding	
	Total Value (# shares * share price)	
	$r_s = R_f + (R_M - R_f)\,\beta s$	
	Cost of Internal Equity r_s =	

Preferred Sto	P_0	
	Shares outstanding	
	Dividend	
	Total Value (# shares * share price)	
	$r_P = D / P_0$	
	Cost of Preferred stock r_P =	

Tax Rate	
WACC = $w_c * r_s + w_p * r_p + w_d * r_d * (1-T)$	
WACC =	

Appendix G. Final Project Deliverable – Capital Budgeting (Part I)

Part 1. Input Data (Thousands of dollars)

Building cost		Market value of building in 2018	
Equipment cost		Market value of equipment in 2018	
Investment in Net operating WC		Tax rate	
Sales in units per year (first year)		Required Rate of Return (WACC)	
Growth rate in units sold		Building Depreciation (# of Years)	
Sales price per unit (first year)			
Growth rate in sales price			
Variable cost per unit			
Annual Fixed Costs			

Part 2. Depreciation Schedule

	Years			
	2015	2016	2017	2018
Building depreciation rate (Straight-line)				
Building depreciation expense				
Cumulative depreciation				
Ending book value:				
Equipment depreciation rate (MACRS)				
Equipment depreciation expense				
Cumulative Depreciation				
Ending book value:				

Part 3. Salvage Value Calculations

	Building	Equipment	Total
Estimated Market Value in 2018			
Book Value in 2018			
Expected Gain or Loss			
Tax Liability or Credit			
Net cash flow from Salvage			

Appendix G. Final Project Deliverable – Capital Budgeting (Part II)

Part 4. Projected Cash Flows

	Years				
	0	1	2	3	4
Investment Outlays at Time Zero	2014	2015	2016	2017	2018
Building					
Equipment					
Increases in Net Working Capital					
Operating Cash Flows over the Project's Life					
Units Sold					
Sales Price					
Sales Revenue					
Variable Costs					
Fixed Operating Costs					
Depreciation (building)					
Depreciation (equipment)					
EBIT					
Taxes on Operating Income					
NOPAT (net operating profit after tax)					
Add Back Depreciation					
Operating Cash Flow					
Terminal Year Cash Flows					
Return of net operating working capital					
Net salvage value					
Total termination cash flows					
Projected Cash Flows					

Part 5. Appraisal of Proposed Project

NPV	
PI	
IRR	
MIRR	
Payback (years)	
Discounted Payback (years)	

Classroom Polar Vortex: Using Threaded Discussions to Manage Mother Nature's Insistent Behavior

Sarah Burke
Villanova University

Patricia Robak
Drexel University

Threaded discussions are a common method of conversation in both online and blended classes. Research is mixed as to whether threaded discussions are a superior method of instruction. There is little doubt, however, that they offer a flexible and viable learning environment for dealing with unavoidable interruptions in the course schedule. This paper offers a methodology for introducing threaded discussions in a traditional face-to-face classroom where circumstances, such as inclement weather, force the instructor or the university to cancel class. These discussions provide a valuable tool to replace and/or supplement traditional meetings with a guided conversation that can be used to foster student participation and reflective learning.

Introduction

Threaded discussions are interactive online conversations among members of a common learning community (eg. a course, a section). Typically, they are asynchronous, meaning participants will offer insights at various points in time rather than in real time but within some overall time parameters as set forth by the instructor. Unexpected class cancellations such as inclement weather or instructor illness are an interruption at any education level, but are a particular challenge in higher education where published calendars, syllabi and curriculum guidelines often leave little room for flexibility. Student participation in threaded discussions provide a solution for incorporating missed sessions into the curriculum. The following presents a methodology that is used in introductory undergraduate courses in both Economics and Corporate Finance. The purpose of this methodology is to replace and/or supplement traditional meetings that have been cancelled with a guided conversation that can be used to foster student participation and reflective learning. The methodology is flexible enough to be readily applied to

any undergraduate or graduate course where students have access to a common online communication system or learning management system (such as Moodle, eCollege or Blackboard).

One major benefit of threaded discussions is the creation of a rich peer learning process. This offers a greater depth of student feedback and allows students to benefit from the contributions of all class members. Reticent students who are often reluctant to participate in broader classroom discussions are forced to contribute their thoughts and ideas. Additionally, the asynchronous timing allows for well thought-out and reflective responses. For the instructor, threaded discussions offer a method to conduct class without the physical presence of its members. The discussion can take place over a period of time with a finite conclusion, at which point the instructor can review and assess the students' level of comprehension and understanding.

Benefits of Threaded Discussions

Research is mixed as to whether threaded discussions are a superior method of instruction (Maurino, 2007). There is little doubt, however, that they offer a flexible and viable learning environment for dealing with unavoidable interruptions in the course schedule. Many benefits arise for utilizing threaded discussion is these situations, such as flexibility, increased student satisfaction, unconstrained time limits, inclusivity, and dealing with current events and ethical issues. In the following section, we will expound on the nature of these benefits.

In the event of unexpected changes in the course schedule, there is little doubt that flexibility is paramount to maintaining the validity of the curriculum. Typically, unexpected changes in the course schedule are difficult to accommodate due to their unforeseen nature. Threaded discussions offer a method to quickly and suitably react to such circumstances providing the instructor the ability to sustain the quality of the course. Secondly, in a review of the research dedicated to online threaded discussion, Martyn (2004) finds that online discussions have the potential to increase both satisfaction and perceived learning. Hammond (2005) finds a lack of statistical evidence comparing the effectiveness between online and face to face discussions but an overall consensus "that asynchronous online discussion was potentially valuable or very valuable as a support for teaching" (p. 15). Additionally, the unconstrained timing also allows students to post deliberate and well thought out comments. "Students have the time and resources to do further research on a topic or ponder a point before responding. Used properly, such delays enrich and inform the dialogue" (Bouchat, 2007, p. 2). Fourth, threaded discussions are inclusive. All students can post comments to a question or topic, something that is not possible in a purely face to face class. It forces participation from diffident students who are often reluctant to participate in broader classroom discussions.

Further, stronger personalities who sometimes dominate in-class discussions are required to consider and react to the commentary of their classmates.

One major benefit of threaded discussions is they have the flexibility to deal with current issues, student interests and up to the minute news events. Thus, amidst the schedule interruptions, threaded discussion can be used to maintain the validity of the curriculum in a way that begets actual and current events related to the course. In other words, it provides the opportunity to introduce such topics to the class. For example, in a finance course where the curriculum deals with the impact of insider trading, a Wall Street Journal article on the defeat of the SEC's efforts to enforce strict implementation of SEC rules produced an interesting discussion that considered the insider trading regulations as well as the difficulties in effectively enforcing them. Below is an example of how the assignment was delivered.

> Read the *Wall Street Journal* article: "SEC Loses Insider-Trading Case" by Christopher M. Matthews. How can a defendant prove that gains came from legitimate research rather than insider information? Did the government take too long to bring the case to trial? Why or why not? Should the government have to reimburse defendants for legal costs they incur? Why or why not? (Rich, 2014, p.1)

Finally, threaded discussions are a particularly rich outlet for the discussion of ethical issues. The asynchronous nature allows the time for thoughtful and considerate commentary on often uncomfortable topics. The non-face-to-face nature often gives students the confidence to comment on ethical issues beyond the scope that is comfortable in the classroom. For example a reading from a Corporate Finance text titled "Balancing Shareholder Interests and the Interests of Society" focused on two discussion questions (Brigham & Houston, 2015, p.17). The first was a fairly objective discussion of maximizing shareholder wealth through ethical managerial behavior.

Question 1

> Most managers understand that maximizing shareholder value does not mean that they are free to ignore the larger interests of society. Consider, for example, what would happen if Linda Smith (the CEO) narrowly focused on creating shareholder value, but in the process, her company was unresponsive to its employees and customers, hostile to the local community, and indifferent to the effects its actions had on the environment (Brigham & Houston, 2015, p.17).

Discuss the impact these decisions would have on the price of the stock.

The second question approached the same subject matter with a broader ethical base and asked students to consider the ethical impact of disseminating pertinent product information to the public.

Question 2

> Merck's research indicated that its Vioxx pain medicine might be causing heart attacks. However, the evidence was not overly strong, and the product was clearly helping some patients. Over time, additional tests produced stronger evidence that Vioxx did pose a health risk" (Brigham & Houston, 2015, p.19).

What is Merck's responsibility? Discuss the timing of the announcement. What would the impact be on the stock price?

Interestingly, the first question produced threaded discussions that yielded a fairly consistent outcome across groups. Student arrived at relatively homogeneous conclusions that the company would feel the ill effects on its stock price, imposed by society, if ethical behavior was not followed, through boycotts, litigations, etc. The second question, however, resulted in a layered analysis that considered several options to making the announcement and the subsequent benefits and costs to society. In this evaluation, variation among groups was conspicuous. Each group arrived at distinctive results that integrated varying ethical perspectives. Thus, we have found that threaded discussions provide a space for rich dialogue particularly those with ethical or controversial themes.

Challenges of Threaded Discussions

Use of threaded discussions comes with some challenges, however experience has enabled us to provide some suggestion for solutions to these challenges. First, the asynchronous timing of threaded discussions means that there can be long intervals between posts producing some incongruences to the discussion. To abet, consider entering the discussion at some point during the open period to guide the commentary and stimulate an increase in responses. Also, modify the amount of time students have to comment and/or require a more finite response time per post. Secondly, the sequence of postings is sometimes confusing as late participants often post on earlier comments. Consider nesting for out-of order postings to help the flow of the discussion. Thirdly, threaded discussions require carefully planning with clear, complete and self-supporting instructions to students. There is limited or no ability for instructors to clarify instructions or respond to questions

as there is in face to face discussions or in-class assignment. The more detailed and specific instructions will result in achieving the intended goal of the assignment. Lastly, tangential conversations can easily arise in threaded discussion forums and instructors have limited ability to control the direction of the discussion unless they actively monitor each group's discussion. It may become necessary to direct or cut-off student's line of dialogue. In addition, instructor level access to learning management systems allows for deletion of inappropriate or misdirected commentary.

Guidelines for Instructors

Adjustments to a course schedule can be difficult to acclimate, however threaded discussions are a viable proxy for such situations. To be efficacious, advanced and conscientious planning is the key to success. We would like to offer some suggestions and insights that we have garnered from our experiences in using threaded discussions under these conditions.

The following four "D's" provide a suggested framework for the development of a threaded discussion assignment that can be used for adaptations to the course schedule: Draft specific instructions, Divide the class into groups, Delineate a grading rubric, Draft questions in advance.

Draft Specific Instructions

Take the time to write clear and complete instructions to students. The "purpose, task and participations expectations should be entirely self-evident to a student without further intervention from the instructor" (Bouchat, 2007). Any uncertainty on expectation or how to begin will result in student frustration and deficient discussions. The time line for the assignment should be clearly stated. This includes the overall length of time students will have to complete the assignment as well as the possibility of a specific schedule of postings within the overall time frame. For example, the overall time frame might be one week, however students could be required to make their first post within the first three days and their second post during the remaining four days. Consider adding "Snow Day" instructions to the syllabus or supplemental information and discussing the scope and nature of the assignments on the first day of class. (See below for a sample inclusion to the syllabus)

Divide the Class Into Groups

Consider dividing the class into smaller groups. Research has been conducted on the ideal group size for effective threaded discussions. While there is some

variance in the results, overall the research suggests that a range of 4 to 9 students per group is effective (Berry, 2008). Our experience advocates a slightly narrower range of 5 to 7 students is the most effective in promoting learning. Again, advance thought ought to be given to the method for dividing the class into groups and should be stated in the initial documentation provided in the syllabus. (See below for a sample inclusion to the syllabus.)

Delineate a Grading Rubric

Research indicates that grading threaded discussion posts is imperative for the integrity of the assignment. Students are more likely to produce validated work when a grade is associated with the assessment. Berry (2008) states, "assessment or grading of asynchronous postings and replies is an essential component" (p. 4). In addition, the methodology by which a grade is assessed should be demarcated with a clear rubric (Berry, 2008). Qualities such as, but not limited to, level of participation, quality of comments, level of collaboration and timing of postings can be included in the rubric (Mossavar-Rahmani & Larson-Dougherty, 2009). Figure 1 demonstrates an example of a threaded discussion grading rubric.

Figure 1. Sample Grading Rubric.

	Exceptional	Good	Poor
Level of Participation			
Quality of Comments			
Level of Collaboration			
Timing of Postings			

Draft Questions in Advance

Before the start of the semester, consider drafting several discussion questions that are relevant, but independent of the sequence of the curriculum. Such questions can be used at any point in the course schedule providing flexibility during an unanticipated event. Further, keep in mind that the flexible nature of threaded discussions means cancellations do not have to be immediately after the missed class session. These "make-up" sessions can be done at any time during the term to satisfy the legitimacy of the course curriculum.

Sample Inclusion to Syllabus

Below is a sample of instruction to be included in the syllabus which outlines the specific instructions, the delineation of groups and the details of the grading procedure.

Sample of Instruction

In the event that our class is canceled due to snow/weather conditions, we will make-up the class with group online discussions. The threaded discussions can be accessed from our course website in Blackboard. Instructions will be emailed by noon on the day of the canceled class and the discussion will open at noon on the day following the cancelation. You will have 4 days (96 hours) to complete your participation in the group discussion. For example, if class is canceled on Wednesday, January 29, 2014, instructions will be emailed by noon on January 29, 2014 and the class discussion will be open from noon on January 30, 2014 through noon on February 3, 2014.

The class is divided into 5 groups as follows. If you are assigned to Group 1 you should participate in the Group 1 discussion board in Blackboard.

Group 1- Adams, Burke, Carr, Dylan, Egan
Group 2- Frank, Gavin, Harrison, Imery, Jackson, King
Group 3- Lee, Meyers, Nico, Oreo, Prince
Group 4- Quinn, Robak, Scott, Taylor, Upp
Group 5- Voss, White, Xu, Yarnell, Zimmer

There will be two discussion topics. Topics will most likely come from a reading assignment from our class text and/or a *Wall Street Journal* article that will be posted with the discussion. The discussion requirements are (1) make at least one substantial comment to each of the two discussion topics and (2) provide (at least) TWO responses to postings of others (note: you should have a total of (at least) 4 postings: 2 comments and 2 responses).

Although they are not done in real time, the exchanges should be lively. Agree and support your arguments or those of others, as you think appropriate. If you disagree with someone's thoughts, provide and support those insights as well. Page long offerings are not necessary. Provide your thoughts in a paragraph or a few relevant sentences to make your point. Keep in mind that simply saying that "I agree" or "I think that I disagree with that", is, obviously an insufficient contribution. You will not earn full participation credit if your postings are too short or too long.

In addition, it is useful to provide some internet etiquette or "netiquette" to your students to aid in the formality and legitimacy of the online assignment as student skills. Listed below are some Netiquette guidelines adopted from Sparknotes (2011).

1. Think before you post – you can't take anything back.
    a. Once a comment has been posted, there is no way to unpost it.
    b. Never post a comment in the heat of the moment.
    c. When in doubt, don't post it.

2. Be aware that postings are never private.
    a. Avoid posting comments with sensitive or confidential content.
    b. Any comment you post may be forwarded to others, inadvertently left on screen where others can read it, or printed at a public printer and accidentally left where other can see it.
3. Be careful with humor and sarcasm.
    a. Subtleties of body language and tone of voice, which may make something funny in person, are completely lost in online discussions.
    b. Even if you use emoticons (e.g. ;-), ☺, ☹, etc…), sarcasm is difficult to convey in online discussions and can easily result in misunderstandings and hurt feelings.
    c. Crude jokes and insulting language (flaming) typically have sour effects in both the classroom and online discussions, no matter how well the recipients know your sense of humor.
4. Write clearly and use standard grammar and punctuation.
    a. Follow the same rules of style, grammar, and clarity that you would use in writing a real letter. Always be clear and concise.
    b. Reread and spell-check your comments before posting to catch typos.
    c. USING ALL CAPS IS THE ONLINE EQUIVALENT OF SHOUTING AND PROBABLY WILL ANNOY YOUR AUDIENCE.
4. Don't use fancy colors and fonts.
    a. Fancy colors and fonts may create clutter and distracts from the content of your message.
    b. Something that looks great on your screen may come through as a bunch of garbled characters on the recipient's computer.

Conclusions

Threaded discussion can take various formats. This methodology focuses on implementing a threaded discussion for the purpose of maintaining the integrity of a full curriculum despite unavoidable cancelations and interruptions during the course term. It works well at both the undergraduate and graduate level where students are mature enough to offer insightful comments on potentially complex issues, and are willing to think beyond discovering one concrete solution. One clear benefit is the asynchronous nature of threaded discussions is the ability of students to participate in the conversation at any time of day during the discussion period. This is especially helpful in the case of cancellations or changes where real-time schedules are unlikely to have the flexibility or ability to add additional class time. Additionally, threaded discussions have the benefit of increasing student satisfaction, creating an inclusive environment and providing the ability to address difficult topics with thoughtful responses. In order to obtain the maximum

benefit of threaded discussions used for class interruptions, we highly recommend careful, pre-planned guidelines that include specific self-evident instructions, group allocations, a grading rubric and potentially pre-drafted questions. Use of this methodology will result in a flexible and effective method to manage unexpected breaks in the course schedule.

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Bloomberg 201: From Wall Street to University Avenue

Manoj Athavale
Ball State University

Joseph Edwards
Estep * Doctor & Company, PC

Kristopher J Kemper
Ball State University

Traditional education tends to emphasize acquiring knowledge and demonstrating an understanding of facts and ideas. While knowledge and comprehension do form the foundation of a good education, there is increasing evidence that use of a larger practical component enhances business school graduates' performance. In turn, we argue that educators should therefore try to equip students for the technology they are likely to encounter and the skills they are likely to need. This paper provides a series of applications using the Bloomberg Professional Service designed to contribute to the quality of education and provide students with the opportunity for engaging hands-on training and the confidence to be effective in the workplace.
Keywords: *Bloomberg, Excel, Experiential Learning, Investments, Student Managed Investment Funds*

Introduction

A primary focus of business schools today is to ensure that students are equipped with the knowledge, tools and skills necessary to succeed in an increasingly competitive workplace. One of the ways this has been accomplished is by integrating relevant professional technologies into the curriculum. Pfeffer and Fong (2002) have suggested that a larger clinical or practical component may be essential to imparting lasting knowledge that affects the performance of business school graduates. This opinion has been confirmed by Hawtrey (2007) who states that students expect an enhanced learning experience and indicate a clear preference for experiential learning, although Hawtrey makes no claims about the benefits of experiential learning. Within the finance curriculum, Investments courses are often used to elevate learning from the lower cognitive

levels of knowledge and comprehension to higher cognitive levels of analysis, synthesis and evaluation. Schadler (2007) provides examples of how practical learning experiences using readily available sources can be easily incorporated in Investments courses to achieve higher levels of learning, while Payne and Tanner (2011) propose a financial technology course in the undergraduate finance curriculum. To further their mission, many business schools have therefore made substantial programmatic allocations to experiential learning tools like student-managed investment funds (Mallet, Belcher & Boyd, 2010), dedicated physical facilities like trading labs (Kish & Hogan, 2012), and specialized industry-standard information technologies like the Bloomberg Professional Service (BPS) (Coe, 2007; Scott, 2010).

BPS has been a source of financial information and research since the mid 1980's when Michael Bloomberg created the platform and began marketing it to investment banks around the world. Today, Bloomberg terminals (computers which allow access to BPS) are found in many different environments, in both financial and non-financial institutions, and many thousands of users worldwide utilize BPS in their everyday professional lives. In addition to BPS, other platforms (for example, Thomson Reuters, FactSet, Standard and Poor's Capital IQ, and Morningstar Direct) also provide various combinations of news, historic and current data, analytical tools, research capabilities, communication and transactional capabilities. Although there are several avenues for students and professionals to acquire financial information, our paper focuses on BPS, with its seamless integration of data, news and analytics, providing a powerful and flexible all-inclusive platform. Our experience has shown us that BPS can also enrich curriculum and empower students. Students are empowered knowing that they are using the same information platform utilized by many decision makers and top executives in business, finance and government. The students are using a tool that is powerful and flexible due to its ability to seamlessly integrate historical and real-time business data, news and analytics in a single comprehensive platform. As such, BPS can bring the world of business and finance to the classroom and expose students to content needed in the profession. While there are certainly many sources of financial information, BPS terminals have been increasingly finding their way into academic settings and this is our primary focus. In this paper, we describe our efforts to enhance the learning experience by integrating the BPS platform into a two-course Investments sequence.

Bloomberg in the Classroom

Scott (2010) reports 868 Bloomberg terminals at 382 colleges and universities in 2007. According to Bloomberg LP, there has been significant growth in Bloomberg's presence across the top institutions worldwide in recent years.

Academic institutions now employ over 6,000 terminals (personal communication, J. Pannikot, Bloomberg LP, October 9, 2014). In providing an introduction to BPS, Scott also describes his experience in teaching a one-credit Bloomberg Certification course to upper-level undergraduate students. The Bloomberg Certification training, which is part of BPS and offered on the terminals themselves, reduces students' apprehensions about the extent of information and complexity of the system, while also providing them with external validation for their efforts. While the structure and content of the training modules has evolved over time, the pedagogical process described by Scott can still be applied today. The familiarity and skill derived as a result of the certification process can then be applied to specific classroom situations. Coe (2007) believes that use of Bloomberg technology brings increased currency in the education that finance classes offer to students, enhances the students' ability to analyze data and communicate information and also facilitates the transition from the classroom to the workplace. BPS contains a wide array of current and historic information. Coe illustrates its use in explaining some concepts in financial management, investments, international finance, derivatives and banking courses. More importantly, Coe finds that despite the perception of having a high cost, a BPS terminal can be a cost-effective and convenient alternate to library resources.

The use of BPS terminals in a classroom setting can have many benefits for students. It can increase the students' ability to perform research and analysis in nearly every facet of finance, and provide them with a competitive advantage in a competitive job market. Equity, fixed income, foreign exchange, and commodity analytics are enhanced greatly by the ability to find, interpret and integrate relevant information. Use of BPS terminals is not restricted merely to the Finance curriculum as BPS functionality can be useful not just in related disciplines like Accounting and Economics, but also in Market Research, Supply Chain Management, Data Analytics and International Business courses.

Bloomberg in our Classroom

The Investments curriculum at Ball State University comprises a two-course sequence which is required of all finance majors. The Investments I course is the introductory course in investments and is the pre-requisite to the Investments II course in portfolio management. Traditionally, most students take these courses in consecutive semesters. We have integrated the BPS experience into the curriculum of both these courses and this section briefly describes our process and provides instructors with material that can be adapted for their use.

Our efforts in introducing students to BPS were based on some predeterminations. First, we did not want the students to be overwhelmed by the breadth and depth of the technology available to them. Hence, we decided that the BPS process would

be covered over a two-semester sequence and follow Bloom, Englehart, Furst, Hill and Krathwohl's (1956) taxonomy in its application.

Knowledge. We decided to proceed sequentially with students gaining knowledge and confidence in the Investments I course through self-paced certification content that is available on the terminals. As a component of this course, students complete the certification process described by Scott (2010) and earn credit toward their final semester grade while gaining relevant knowledge and developing the necessary skills needed to apply that knowledge in the Investments II course. The successful completion certificates provided by Bloomberg also provide students with external validation of their familiarity with the Bloomberg system.

Comprehension. We also wanted students to become comfortable with using the terminals and the content available to them. In line with this goal, we created a sequence of assignments which would be used concurrently with the Investments I course content. These assignments were expected to simultaneously facilitate ease of grading for the instructor while also reinforcing course content.

Application. Next, we wanted to provide the students with the opportunity to apply their knowledge and skills; and we were able to do that by allowing the students to manage an asset portfolio (the Student Managed Investment Fund) in Investments II. In this course, we required the students to develop a reusable valuation template encompassing various standard equity valuation models. An additional goal is that students walk away from the classroom with a tangible tool which would be relevant to their workplace or for their personal needs.

Analysis. After creating the reusable valuation template in Excel, students then analyze the relationships between financial inputs (revenues, costs…) and financial outputs (stock price). Students examine how changes in core variables affect stock prices. Through experimentation with forecasted variables through the use of sensitivity analysis, students can distinguish the largest drivers of market reactions.

Synthesis. Students in Investments II synthesize both qualitative information assembled through examinations of financial reports, and also quantitative findings they have assembled through the mastery of BPS. The end result is a final stock report that is also presented orally to both the instructor and fellow students.

Evaluation. The final stage in a student's movement through the cognitive learning process is a buy/hold/sell recommendation. The merits of this position are then evaluated by the course instructor. The instructor assesses the depth of BPS knowledge the students have gained and also their ability to apply that knowledge to portfolio management. When students make recommendations about taking a position in a particular security, it is after they have moved sequentially through the cognitive process.

The pedagogical process described above did not fall into place all at once, but came together over several semesters after several early missteps. Of course,

our approach will continue to evolve with the changing needs of our students. We believe that the current process allows us to blend academic theory with reinforcing assignments, external validation and real-world hands-on asset-management experience. In the next section, we discuss the specific elements of this process as they relate to the steps in the taxonomy of Bloom et al. (1956).

Assignments to Reinforce Concepts

These assignments presume a basic working familiarity with the Bloomberg terminal. Students gain an increasing familiarity with the Bloomberg terminals over the course of the semester by completing the Certification process interspersed with some combination of the assignments described in this section. The Bloomberg Certification process itself is described by Scott (2010) and currently comprises five modules. The first module comprises four units and is collectively called Bloomberg Essentials while the next four modules offer exposure to equity, fixed income, foreign exchange and commodities. We expect all our students to complete each of these modules.

The assignments used in Investments I increase students' confidence in working with the Bloomberg terminals and also help reinforce the theoretical concepts which are introduced in this course. These assignments are presented below in no particular order and can be modified by instructors to meet their specific learning goals.

ASSIGNMENT 1 (Basic Financial Analysis): This assignment explores the various financial statements over time and interprets key statistics and ratios.

Steps for Completion: Log in to your Bloomberg account; begin typing the company name (an example would be "The Coca-Cola Company") into the command bar at the top of the screen; then, use the mouse to click on the desired auto-filled option (an example would be KO US EQUITY). Once the company home page has been accessed, type "FA" into the command bar and press enter to access financial statement information. Explore the various options available.

Deliverables: Attach a single landscape-mode screen capture of the "Key Stats" tab to your one-page report. Your one-page report should (1) present the Gross Profit Margin (a Profitability Ratio), Interest Coverage Ratio (a Debt Ratio), Quick Ratio (a liquidity Ratio), Daily Sales Outstanding (an Effectiveness Ratio), and the P/E Ratio (a Market Ratio) for the most recent year, and (2) very briefly explain the calculation of each ratio, and the trend in each of these ratios over the past five years.

ASSIGNMENT 2 (Beta): This assignment will reinforce the concept of beta for a given company.

Steps for Completion: Once the home page for a company has been accessed, type "BETA" into the command bar and press enter. Explore the various options available.

Deliverables: Attach a single landscape-mode screen capture of the data to your one-page report. Your one-page report should (1) present the beta value obtained using sixty monthly observations, (2) briefly explain the relevance of R^2 in the linear regression analysis, and (3) comment on the relative systematic risk of your company.

ASSIGNMENT 3 (Weighted Average Cost of Capital): This assignment will reinforce the concept of WACC for a given company.

Steps for Completion: Once the home page for a company has been accessed, type "WACC" into the command bar and press enter. Explore the various options available.

Deliverables: Attach a single landscape-mode screen capture of the data to your one-page report. Your one-page report should (1) present the WACC value obtained for the most recent time period, (2) briefly explain the calculation of the cost of each capital component, and (3) comment on the relevance of the EVA spread and its trend over the past few years.

ASSIGNMENT 4 (Prices and Returns): This assignment reinforces the concept of prices and returns and provides a histogram of returns as an introduction to the concept of risk.

Steps for Completion: Once the home page for a company has been accessed, explore Historic Prices by typing "HP" into the command bar and pressing enter. Familiarize yourself with the various options available. Change the period from daily to yearly, customize the date range to include 15-20 years of data, and press enter to view year-end prices along with the high and low prices over the selected period. Access the Historic Returns Histogram by typing "HRH" into the command bar and pressing enter. Explore the various options available. Change the Type to Total Return and the Period to Monthly, and customize the date range to include about 200 observations and the number of bins to 10. Then press enter to view a histogram of monthly total returns and some other univariate statistics over the selected period.

Deliverables: Attach one landscape-mode screen capture of the Historic Prices data and a second screen capture of the Historic Returns Histogram to your one-page report. Your one-page report should (1) identify the average monthly return over the selected period, (2) explain how the price range and the standard deviation can be a proxy for risk, (3) explain the trend in prices over the selected period, and (4) explain the difference between price return and total return.

ASSIGNMENT 5 (Economic Analysis): This assignment increases awareness of the many available economic indicators useful to both finance and economics majors.

Steps for Completion: After logging in, type "ECOF" into the command bar and press enter to access the Economic data Finder. Here, you will see a menu of several categories of economic information. Explore the various options available and obtain the University of Michigan survey 1yr ahead inflation expectations

along with the most current Unemployment Rate from the Bureau of Labor Statistics. You can also use the mnemonic "ECST" to search for various World Economic Statistics.

Deliverables: Attach a landscape-mode screen capture of the inflation expectations and a second screen capture of the unemployment rate to your one-page report. Your one-page report should (1) identify the expected rate of inflation, and describe how inflation expectations have changed over the past three years, (2) describe the relationship between education and the unemployment rate, (3) explain the concept of Leading, Coincident, and Lagging economic indicators, and (4) make a forward looking inference about the state of the economy, citing specific information (obtained in your explorations) which supports your opinion.

ASSIGNMENT 6 (Industry Analysis): This assignment provides the components necessary for the second step in a three-step (Economic, Industry, Company) top-down fundamental analysis.

Steps for Completion: After logging in, type "BI" into the command bar and press enter to view a list of ten Industries. Select the Health Care industry and then select the Medical Device sector. You will see various categories of information on the left side of the screen, and several key measures on the right side of your screen. Explore the various options available.

Deliverables: Attach a landscape-mode screen capture of the Medical Device sector Home screen to your one-page report. Your one-page report should (1) identify 4 of the largest companies in this sector and their ESG (Environmental, Social, and Governance) rank, (2) highlight the average 1yr Total Return, forward P/E Ratio, and Dividend Yield for the sector, (3) explain how you might incorporate the ESG rank in the investment process, and (4) make an inference about the prospects for the Medical Device sector, citing specific information (obtained in your explorations) which supports your opinion.

ASSIGNMENT 7 (Company Analysis): This assignment initiates company analysis by familiarizing students with the *who* (Management), the what (Product segmentation), and the where (Geographic Segmentation) of the company.

Steps for Completion: Once the home page for a company has been accessed, type "DES" into the command bar and press enter to view a broad company description. Then, type "FA" into the command bar and press enter to review the many options available for analysis including the Segments tab for revenue by region and revenue by line of business. Then, type "MGMT" into the command bar to explore company management.

Deliverables: Using information for the most recent year, your one-page report should (1) highlight the proportion of revenue derived in the U.S., (2) highlight the proportion of revenue derived from Non-Alcoholic Beverages, and (3) identify the CEO and CFO, with information about their age and their tenure in that position.

ASSIGNMENT 8 (Fixed Income): This assignment is a quick introduction to the U.S. Treasury Securities market.

Steps for Completion: Access the Bloomberg Treasury and Money Markets home page by typing "BTMM" into the command bar and pressing enter. Note that you can position your mouse pointer over the top of each figure on the screen and a small window will pop up with an explanation. Explore the various options available.

Deliverables: Attach a single landscape-mode screen capture of the home page to your one-page report. Your one-page report should (1) highlight the yield on 6-month maturity T-Bills and 180-day maturity Commercial Paper and also explain the yield differential, (2) highlight the yield on 1-year T-Bills and 30-year T-Bonds and again explain the yield differential.

ASSIGNMENT 9 (Foreign Exchange): This assignment is a quick introduction to spot and forward foreign currency markets.

Steps for Completion: Access the Currency rates Matrix by typing "FXC" into the command bar and pressing enter. You will see the major currencies in a heat map view, with currencies trading higher in green and currencies trading lower in red. Explore the various options available, and then type "WBG" into the command bar and press enter to obtain the price of the Big Mac sandwich in various countries.

Deliverables: Attach a single landscape-mode screen capture of the spot currency data to your one-page report. Your one-page report should (1) highlight the spot U.S.$ value of 1 EUR and the price from exactly 1 year ago, (2) highlight the range (high and low) of prices for the EUR over the last 15 years, and (3) explain the Big Mac Index and its possible relevance to the foreign currency markets.

ASSIGNMENT 10 (Equity Screening): This assignment allows students to screen for companies which meet specified criteria.

Steps for Completion: Type "EQS" into the command bar and press enter. You will see broad categories available for screening and you can also add other criteria and Boolean operators. Explore the various options available.

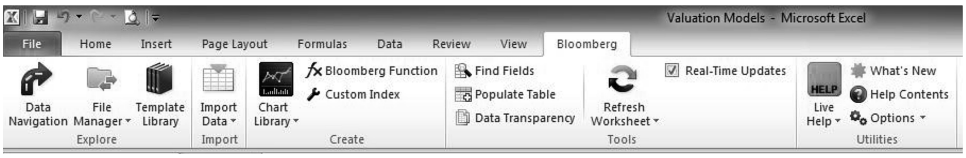
Deliverables: Use appropriate criteria to narrow the number of companies to fewer than 20. Attach a single landscape-mode screen capture of your screening criteria and a second single landscape-mode screen capture of the resulting companies to your one-page report. Your one-page report should (1) indicate your rationale for choosing each of the screening criteria, and (2) identify just one company (from your results) which you would consider for additional analysis and your rationale for selecting that company.

After completing the first Investments course the students become aware of Investment concepts, have attained Bloomberg certification in all areas, and have become familiar with the information available in BPS. The Investments I course is a prerequisite to the Investments II course and most of the students who complete the first course also enroll in the second.

Equity Valuation Models

The second Investments course generally covers portfolio management. In addition to the theoretical concepts, the students are also responsible for managing the Student Managed Investment Fund (SMIF). The SMIF currently manages approximately $900,000 as part of the University Foundation's portfolio, and per the current mandate, the SMIF invests in large-cap, domestically-traded, equity-type securities. Consequently, the course emphasizes the creation and management of an equity portfolio. A major component of this course is the application of the students' familiarity with BPS to the many valuation models that are traditionally covered in Investments courses. After students learn several valuation models, they build a reusable Excel template which assists in the valuation process. There are a few interesting dimensions to this template. First, it uses the Bloomberg Excel add-in to access data from Bloomberg. Second, it is reusable, and changing the ticker symbol changes the data underlying the valuation models. Finally, the template is flexible. Some inputs can be changed to tailor the results to a specific situation or as part of a scenario analysis. The special features of the Bloomberg Excel add-in are presented in Exhibit 1.

Exhibit 1: The Bloomberg Excel Add-In.



This add-in can access data from BPS and place it in an Excel worksheet to later facilitate analysis. A variety of "wizards" and "drag and drop" capabilities facilitate data extraction. Alternately, you could use the BDP (Bloomberg Data Point), BDH (Bloomberg Data History), and the BDS (Bloomberg Data Set) formulae depending on the type of data to be extracted. The BDP formula is useful in obtaining a single data point; the BDH formula is useful in obtaining historic data for a selected timeframe, and the BDS formula is useful in obtaining multi-cell data sets.

The valuation exercise results in the creation of an Excel workbook comprising multiple worksheets. To avoid some idiosyncrasies in the format of the workbook and worksheets, we recommend some standardization. An example of such a workbook is described in this section. We use the first worksheet for Inputs and Outputs – this worksheet allows for inputting, for example, the ticker symbol of the company being valued and ticker symbols of its closest competitors. The results obtained from the valuation process are also summarized here. A typical Input and Output worksheet is presented in Exhibit 2a and 2b.

Exhibit 2a: Input and Summarized Output Worksheet.

	A	B	C	D	E
1	**Ticker**	hpq US Equity			**Competitors**
2					fisv US Equity
3					adp US Equity
4					emc US Equity
5					wdc US Equity
6					
7	**Price Summary**				
8	Dividend Growth Model	14.22			
9	Market Multiples	63.22			
10	Holding Period Return	29.54			
11	Enterprise Value	61.04			
12	Residual Income	60.85			
13	Free Cash Flow	66.45			
14					
15	Average of 6 models	49.22			
16	Average without high/low	53.66			
17					**Potential**
18	current price	35.34			BUY/HOLD
19					

InOut | DG | MM | HPR | EV | RI | FCF

Exhibit 2b: Formulae underlying Input and Summarized Output Worksheet.

	A	B	C	D	E
1	**Ticker**	hpq US Equity			**Competitors**
2					fisv US Equity
3					adp US Equity
4					emc US Equity
5					wdc US Equity
6					
7		**Price Summary**			
8	Dividend Growth Model	=DG!B12			
9	Market Multiples	=MM!C11			
10	Holding Period Return	=HPR!B13			
11	Enterprise Value	=EV!C19			
12	Residual Income	=RI!E24			
13	Free Cash Flow	=FCF!B21			
14					
15	Average of 6 models	=AVERAGE(B8:B13)			
16	Average without high/low	=(SUM(B8:B13)-MIN(B8:B13)-MAX(B8:B13))/4			
17					**Potential**
18	current price	=BDP(B1,"PX_LAST")			=IF(B16>B18,"BUY/HOLD","SELL")
19					

InOut | DG | MM | HPR | EV | RI | FCF

Exhibit 2a identifies the company being analyzed (HPQ) and the four competing companies used in this exercise (FISV, ADP, EMC, and WDC). The results of the six valuation models (Dividend Growth, Market Multiples, Holding Period Return, Enterprise Value, Residual Income, and Free Cash Flow) are presented individually, together with the simple average ($49.22) and truncated average ($53.66). We use the truncated average as our estimate of intrinsic value, and this

Exhibit 3a: Dividend Growth Model Worksheet.

	A	B	C	D	E
1	**Ticker**	hpq US Equity			**Competitors**
2					fisv US Equity
3					adp US Equity
4					emc US Equity
5					wdc US Equity
6					
7		**Price Summary**			
8	Dividend Growth Model	=DG!B12			
9	Market Multiples	=MM!C11			
10	Holding Period Return	=HPR!B13			
11	Enterprise Value	=EV!C19			
12	Residual Income	=RI!E24			
13	Free Cash Flow	=FCF!B21			
14					
15	Average of 6 models	=AVERAGE(B8:B13)			
16	Average without high/low	=(SUM(B8:B13)-MIN(B8:B13)-MAX(B8:B13))/4			
17					**Potential**
18	current price	=BDP(B1,"PX_LAST")			=IF(B16>B18,"BUY/HOLD","SELL")
19					

InOut | DG | MM | HPR | EV | RI | FCF

Exhibit 3b: Formulae underlying Dividend Growth Model Worksheet.

	A	B	C	D	E	F
1	3 year dividend growth rate (stage 1)	=BDP(InOut!B1,"EQY_DPS_NET_3YR_GROWTH")				
2	Long-term (stage 2) growth rate	3				
3	current dividend (annual)	=BDP(InOut!B1,"EQY_DPS")				
4	Cost of Equity	=BDP(InOut!B1,"WACC_COST_EQUITY")				
5						
6			D1	D2	D3	D4
7			=B3*(1+B1/100)			
8				=B3*(1+B1/100)^2		
9					=B3*(1+B1/100)^3	
10						=E9*(1+B2/100)
11						
12	Expected Price	=NPV(B4/100,C7,D8,E9+(F10/(B4/100-B2/100)))				

number is compared with the market price ($35.34) in order to reach a preliminary decision. The worksheet tabs which present the structure of the workbook can also be viewed at the bottom of Exhibit 1.

The next few worksheets (DG, MM, HPR, EV, RI, and FCF) are used for the individual valuation models. The Dividend Growth model is presented in Exhibit 3a and 3b.

The Dividend Growth model presented here is a 2-stage growth model using Bloomberg's expectations of dividend growth to calculate dividends for the next three years followed by a 3% growth rate in dividends thereafter. Note that individual instructors can determine the parameters they would like to use. Note also that the answers presented here by the individual models and the summary may differ by a few pennies because of truncation, real-time changes in values and rounding.

After completing the Dividend Growth model, the students work incrementally on other valuation models. The Market Multiples model is presented in Exhibit 4a and 4b.

Exhibit 4a: Market Multiples Model Worksheet.

	A	B	C	D	E
1	Market Multiples	Competitor 1	Competitor 2	Competitor 3	Competitor 4
2	M/B	2.3305	6.5005	2.5621	2.4870
3	P/E (Trailing)	24.6948	25.6103	21.1800	13.9599
4	P/E (Forward)	18.6712	26.1756	13.6659	11.4016
5					
6					
7	Book Value per Share	15.29	53.0440		
8	Earnings per Share	3.15	67.2674		
9	Forward EPS	3.95	69.0054		
10					
11	Expected Price		63.11		

Exhibit 4b: Formulae underlying Market Multiples Model Worksheet.

	A	B	C	D	E
1	**Market Multiples**	**Competitor 1**	**Competitor 2**	**Competitor 3**	**Competitor 4**
2	M/B	=BDP(InOutlB1,"MARKET_CAPITALIZATION_TO_BV")	=BDP(InOutlE3,"MARKET_CAPITALIZATION_TO_BV")	=BDP(InOutlE4,	=BDP(InOutlE5,
3	P/E (Trailing)	=BDP(InOutlE2,"T12M_DIL_PE_CONT_OPS")	=BDP(InOutlE3,"T12M_DIL_PE_CONT_OPS")	=BDP(InOutlE4,	=BDP(InOutlE5,
4	P/E (Forward)	=BDP(InOutlE2,"BEST_PE_RATIO")	=BDP(InOutlE3,"BEST_PE_RATIO")	=BDP(InOutlE4,	=BDP(InOutlE5,
5					
6					
7	Book Value per Share	=BDP(InOutlB1,"BOOK_VAL_PER_SH")	=B7*AVERAGE(B2:E2)		
8	Earnings per Share	=BDP(InOutlB1,"TRAIL_12M_EPS")	=B8*AVERAGE(B3:E3)		
9	Forward EPS	=BDP(InOutlB1,"EEPS_NXT_YR")	=B9*AVERAGE(B4:E4)		
10					
11	Expected Price		=AVERAGE(C7:E9)		

The Market Multiples model presented here uses the Market to Book ratio, the Price to trailing Earnings ratio, and the Price to forward Earnings ratio to determine the expected price. Individual instructors may weight the criteria or may use different criteria as relevant to the company being analyzed.

The Holding Period model presented in Exhibits 5a and 5b assumes that dividends will be received during the 3-year holding period (based on Bloomberg estimates as mentioned in the Dividend Growth model), and that the security will be sold at the end of that period at the then prevailing P/E ratio. These cash flows are discounted to the present to arrive at the expected price for this company.

Exhibit 5a: Holding Period Return Model Worksheet.

	A	B	C	D	E	F
1	Current Annual Dividend				0.55	
2	3-year Dividend Growth Rate				15.13	
3	Ke				8.4769	
4	PE Estimate in 3 years				8.42	
5	EPS in 3 years				4.20	
6						
7			**D1**	**D2**	**D3**	**P3**
8			0.63			
9				0.73		
10					0.84	
11						35.36
12						
13	Expected Price	$29.56				

Exhibit 5b: Formulae underlying Holding Period Return Model Worksheet.

	A	B	C	D	E	F
1	Current Annual Dividend	=BDP(InOut!B1,"EQY_DPS")				
2	3-year Dividend Growth Rate	=BDP(InOut!B1,"EQY_DPS_NET_3YR_GROWTH")				
3	Ke	=BDP(InOut!B1,"WACC_COST_EQUITY")				
4	PE Estimate in 3 years	=BDP(InOut!B1,"BEST_PE_RATIO_MARKET","BEST_FPERIOD_OVERRIDE=2016Y")				
5	EPS in 3 years	=BDP(InOut!B1,"BEST_EPS","BEST_FPERIOD_OVERRIDE=2016Y")				
6						
7			**D1**	**D2**	**D3**	**P3**
8			=$B1*(1+$B2/100)^1			
9				=$B1*(1+$B2/100)^2		
10					=$B1*(1+$B2/100)^3	
11						=B5*B4
12						
13	Expected Price	=NPV(B3/100,C8,D9,E10+B4*B5)				

The Enterprise Value model presented in Exhibits 6s and 6b uses the EV/EBITDA ratio. The average EV/EBITDA ratio for the competitors is used to estimate EV for our company; adjustments are made for debt, minority interests, preferred equity and cash to then arrive at the expected market capitalization and hence the expected price of each share.

Exhibit 6a: Enterprise Value Model Worksheet.

	A	B	C	D	E
1		**Expected**	**2013**	**2012**	**2011**
2	EBIT	9804.25	7131.00	6978.00	10562.00
3	Taxes	1831.40	1397.00	717.00	1908.00
4	Capital Expenditures	4919.01	3706.00	4539.00	4133.00
5	Change in NWC	872.00			
6	Depreciation	5837.80	4611.00	5095.00	4984.00
7	Free Cash Flow	8019.63			
8					
9	CA		50364	50637	
10	CL		45521	46666	
11	NWC		4843	3971	
12					
13	WACC	7.026			
14	Hist 5yr	-1.428			
15	Hist 3yr	8.986			
16	Estimate	2.000			
17					
18	PV of FCF	159563.89			
19	Long Term Debt	32499.00			
20					
21	Expected Price	66.60			

Exhibit 6b: Formulae underlying Enterprise Vale Model Worksheet.

	A	B	C	D	E
1		**Expected**	**2013**	**2012**	**2011**
2	EBIT	=BDP(InOut!B1,"BEST_EBIT","BEST_FPERIOD_OVERRIDE	=BDH(InOut!B1,"IS_OPER_INC","FY1 2013","FY1 2013","PER=FY")	=BDH(InOut	=(BDH(InOut
3	Taxes	=B2*(C3+E3)/(C2+E2)	=BDH(InOut!B1,"IS_INC_TAX_EXP","FY1 2013","FY1 2013","PER=FY")	=BDH(InOut	=BDH(InOut!
4	Capital Expenditures	=B2*(C4+D4+E4)/(C2+D2+E2)	=-BDH(InOut!B1,"CF_CAP_EXPEND_PRPTY_ADD","FY1 2012","FY1 2(	=-BDH(InOu	=-BDH(InOut
5	Change in NWC	=C11-D11			
6	Depreciation	=B2*(C6+D6+E6)/(C2+D2+E2)	=BDH(InOut!B1,"CF_DEPR_AMORT","FY1 2013","FY1 2013","PER=FY'	=BDH(InOut	=BDH(InOut!
7	Free Cash Flow	=B2-B3-B4-B5+B6			
8					
9	CA		=BDH(InOut!B1,"BS_CUR_ASSET_REPORT","FY1 2013","FY1 2013","F	=BDH(InOut	
10	CL		=BDH(InOut!B1,"BS_CUR_LIAB","FY1 2013","FY1 2013","PER=FY")	=BDH(InOut	
11	NWC		=C9-C10	=D9-D10	
12					
13	WACC	=BDP(InOut!B1,"wacc")			
14	Hist 5yr	=BDP(InOut!B1,"GEO_GROW_FREE_CASH_FLOW")			
15	Hist 3yr	=BDP(InOut!B1,"FCF_PER_SHARE_3YR_GEO_GROWTH")			
16	Estimate	2			
17					
18	PV of FCF	=B7/(B13/100-B16/100)			
19	Long Term Debt	=BDP(InOut!B1,"NON_CUR_LIAB")			
20					
21	Expected Price	=(B18-B19)/BDP(InOut!B1,"BS_SH_OUT")			

The Residual Income model presented in Exhibits 7a and 7b uses previously determined industry-specific coefficients to determine the expected price of the stock. The model demonstrates a 2-period calculation of abnormal or excess returns (income generated by a firm after accounting for the cost of equity) which are then discounted back to the present. The expected price is calculated as 8.86 + 1.16x14.29 + 8.01x4.4221 = $60.86.

The Free Cash Flow model presented in Exhibits 8a and 8b is a 1-stage model. The estimated FCF which is assumed to grow at a constant 2% is discounted using the weighted average cost of capital. The 2% growth rate estimate can be determined using the historic 3-year and 5-year growth rates as benchmarks and based on the instructor's expectations for future growth. Criteria used to estimate taxes, capital expenditures, change in net working capital, depreciation etc. can also be improved by individual instructors.

Exhibit 7a: Residual Income Model Worksheet.

	A	B	C	D	E
1		**Competitor 1**	**Competitor 2**	**Competitor 3**	**Competitor 4**
2	Enterprise Value	20016.50	35256.48	56927.76	19145.46
3	EBITDA	1464.00	2638.40	5815.00	3035.00
4	EV/EBITDA	13.67	13.36	9.79	6.31
5					
6	Average EV/EBITDA		10.78		
7					
8	EBITDA for security		11742.00		
9					
10	Expected EV		126617.90		
11	Shares Outstanding		1908.00		
12					
13	Cash	12163.00			
14	Preferred Equity	0.00			
15	Minority Interest	387.00			
16	Total Debt	22587.00			
17	Expected Market Cap		115806.90		
18					
19	Expected Price		60.70		

Exhibit 7b: Formulae underlying Residual Income Model Worksheet.

	A	B	C	D	E
1		**Competitor 1**	**Competitor 2**	**Competitor 3**	**Competitor 4**
2	Enterprise Value	=BDP(InOut!E2,"CURR_ENTP_VAL")	=BDP(InOut!E3,"CURR_ENTP_VAL")	=BDP(InOut!E4,	=BDP(InOut!E5,
3	EBITDA	=BDP(InOut!E2,"EBITDA")	=BDP(InOut!E3,"EBITDA")	=BDP(InOut!E4,	=BDP(InOut!E5,
4	EV/EBITDA	=B2/B3	=C2/C3	=D2/D3	=E2/E3
5					
6	Average EV/EBITDA		=AVERAGE(B4:E4)		
7					
8	EBITDA for security		=BDP(InOut!B1,"EBITDA")		
9					
10	Expected EV		=C8*C6		
11	Shares Outstanding		=BDP(InOut!B1,"BS_SH_OUT")		
12					
13	Cash	=BDP(InOut!B1,"CASH_AND_MARKETABLE_SECURITIES")			
14	Preferred Equity	=BDP(InOut!B1,"bs_pfd_eqy")			
15	Minority Interest	=BDP(InOut!B1,"minority_noncontrolling_interest")			
16	Total Debt	=BDP(InOut!B1,"SHORT_AND_LONG_TERM_DEBT")			
17	Expected Market Cap		=C10+B13-B14-B15-B16		
18					
19	Expected Price		=C17/C11		

Exhibit 8a: Free Cash Flow Model Worksheet.

	A	B	C	D	E
1		Competitor 1	Competitor 2	Competitor 3	Competitor 4
2	Enterprise Value	=BDP(InOut!E2,"CURR_ENTP_VAL")	=BDP(InOut!E3,"CURR_ENTP_VAL")	=BDP(InOut!E4,	=BDP(InOut!E5,
3	EBITDA	=BDP(InOut!E2,"EBITDA")	=BDP(InOut!E3,"EBITDA")	=BDP(InOut!E4,	=BDP(InOut!E5,
4	EV/EBITDA	=B2/B3	=C2/C3	=D2/D3	=E2/E3
5					
6	Average EV/EBITDA		=AVERAGE(B4:E4)		
7					
8	EBITDA for security		=BDP(InOut!B1,"EBITDA")		
9					
10	Expected EV		=C8*C6		
11	Shares Outstanding		=BDP(InOut!B1,"BS_SH_OUT")		
12					
13	Cash	=BDP(InOut!B1,"CASH_AND_MARKETABLE_SECURITIES")			
14	Preferred Equity	=BDP(InOut!B1,"bs_pfd_eqy")			
15	Minority Interest	=BDP(InOut!B1,"minority_noncontrolling_interest")			
16	Total Debt	=BDP(InOut!B1,"SHORT_AND_LONG_TERM_DEBT")			
17	Expected Market Cap		=C10+B13-B14-B15-B16		
18					
19	Expected Price		=C17/C11		

Exhibit 8b: Formulae underlying Free Cash Flow Model Worksheet.

	A	B	C	D	E	F
1		T = 1	T=2			
2	BVPS	=BDH(InOut!B1,"BOOK_V	=B2+B4-(BDP(InOut!B1,"BEST_DPS")*4)			
3	Ke	=BDP(InOut!B1,"WACC_C	=BDP(InOut!B1,"WACC_COST_EQUITY")			
4	Exp EPS	=BDP(InOut!B1,"BEST_EI	=BDP(InOut!B1,"BEST_EPS","BEST_FPERIOD_OVERRIDE=2015Y")			
5	AER	=B4-(B2*B3)/100	=C4-(C2*C3)/100			
6						
7	PV of AER	=B5/(1+DG!B4/100)	=C5/(1+DG!B4/100)^2			
8	TotAER	=B7+C7				
9						
10		Intercept	BVPS	TotAER	Price	
11	All	7.69	0.9	6.71	=B11+C11*$B$2+D11*$B$8	
12	Finance	3.84	1.06	5.91	=B12+C12*$B$2+D12*$B$8	
13	Health	8.4	1.09	8.86	=B13+C13*$B$2+D13*$B$8	
14	Consumer Non-Durables	7.21	0.76	7.86	=B14+C14*$B$2+D14*$B$8	
15	Consumer Services	7.36	0.93	7.84	=B15+C15*$B$2+D15*$B$8	
16	Consumer Durables	4.1	0.98	5.25	=B16+C16*$B$2+D16*$B$8	
17	Energy	5.15	1.48	5.26	=B17+C17*$B$2+D17*$B$8	
18	Transportation	4.08	1.02	6.49	=B18+C18*$B$2+D18*$B$8	
19	Technology	8.86	1.16	8.01	=B19+C19*$B$2+D19*$B$8	
20	Basic Industries	4.47	1.13	6.2	=B20+C20*$B$2+D20*$B$8	
21	Capital Goods	3.79	1.18	7.47	=B21+C21*$B$2+D21*$B$8	
22	Public Utilities	6.72	1.03	5.97	=B22+C22*$B$2+D22*$B$8	
23						
24	Expected Price				=E19	

After all models have been completed, the summarized valuations available in the Input and Output worksheet are examined. There is usually a discussion about the range of values obtained, and this is a good opportunity for the instructor to discuss the probabilistic rather than deterministic nature of the valuation exercise and the importance of the assumptions underlying each of the models. This is also a good opportunity to discuss the concepts of intrinsic value and market price. At this point, we encourage students to calculate a weighted average of the six estimates by assigning weights to each estimate based on company specific factors (for example, a company with an extremely low or extremely high dividend payout ratio should use a lower weight for the Dividend Growth model). Alternately, the instructor could ask the students to consider taking a simple average of four estimates after eliminating the extreme estimates. This estimate of the stock's

intrinsic value is then compared to the actual stock price, and this an opportunity for the instructor to reinforce the concept of market efficiency. This valuation exercise is also a good opportunity to engage in "what if" scenario analysis to determine the robustness of the estimates to changes in underlying assumptions. In short, the goal here is to experiment with the model inputs, test the strengths and weaknesses of each model and examine the drivers of a stock price to more fully comprehend market movements.

In the Investments II course, students evaluate equity securities using a top-down approach by integrating and organizing information learned over the course of a semester. Students examine economic data to make a judgment about where our economy is currently in regards to the business cycle. Next, students examine sectors and similarly formulate a position about its future prospects. Finally, students study individual companies. This starts with reading a firm's 10-k statements, analyzing firm ratios against its peers, perusing earnings reports and the like. The Excel pricing models developed in conjunction with the BPS system is the main quantitative tool students use to determine relative stock value pricing. The students attempt to relate the qualitative findings with the qualitative results from the pricing models. A final stock report is prepared integrating all of the new student knowledge.

The synthesis of information learned over the two investment courses and refined in real-world application is presented in a 50-minute group presentation at the end of the semester. The presentation concludes with a recommendation about taking a position in the examined security. At this time, the instructor is in a position to evaluate students' growth in financial concepts. Similarly, other students are also in a position to evaluate their peers and offer suggestions for improvement. The students are at the end of the cognitive process and are thus in a position to appropriately recommend a holding position.

Concluding Comments

The primary purpose of this presentation was to demonstrate the integration of relevant industry-standard technology (BPS) in the curriculum. We do not address peripheral issues, viz (1) the merits of active versus passive portfolio management, (2) the relative merits of the specific valuation models, and (3) the validity of the assumptions used in the valuation models. While we have used the Bloomberg terminals, other information providers (for example, Thomson Reuters, Factset, Morningstar, S&P Capital IQ) also provide information which can be used to integrate relevant technology in the curriculum.

Integration of BPS into the curriculum is facilitated by the twelve terminals housed in the Miller College of Business. Our physical facility comprises the traditional lab environment with terminals and dual screen monitors; four LCD

wall display boards and scrolling ticker panels for news, currency and commodity prices, interest rates, and stock price data from NASDAQ and the NYSE.

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Finance through Film: From A to Z

Joseph M. Goebel
Ball State University

Manoj Athavale
Ball State University

Marsha Weber
Minnesota State University Moorhead

This article provides leading class discussion questions relating to a variety of finance topics from 21 production films and five documentaries in the area of finance. Topics include agency theory and costs, conflicts of interest, bankruptcy, capital budgeting, capital structure, corporate governance, corporate restructuring, corporate takeovers, fraud, illegality, SEC violations, information asymmetry, illegal insider trading, social responsibility, time value of money, leveraged buyouts, derivatives, foreign exchange, asset allocation, portfolio diversification, deregulation, national debt, balance of trade, financial intermediation, and insurance. A class discussion of these questions will enable students to gain a greater understanding of the concepts and application of these concepts in a real-world setting.

Introduction

Initial studies focused on the learning process show that picture stimuli are more efficient in fostering long-term paired-associate learning than word stimuli (Baggett, 1979; Deno, 1968; Jenkins, 1968; Paivio & Yarmey, 1966; Peng & Levin, 1979). Champoux (1999) maintains that films are powerful, superior tools for aiding students in learning because control over focusing, framing, editing, camera angles, and sound enables a director to create an experience that is more powerful than reality. Films have been shown to improve classroom student involvement (Bluestone, 2000; Fleming, Piedmont, & Hiam, 1990), critical thinking and analytical skills (Anderson, 1992; Gregg, Hosley, Weng, & Montemayor, 1995), course content recall (Higgins & Dermer, 2001; Scherer & Baker, 1999) and teaching evaluation scores (Boyatzis, 1994).

Educators draw on the powerful experience provided through a variety of commercial and documentary films to aid students in grasping theories and concepts associated with a variety of disciplines. For example, content focusing on influence

tactics, leadership/power, diversity, and escalation theory are of focus in films such as *The Magnificent Seven* (Michaelsen & Schultheiss, 1988), *Aliens* (Harrington & Griffin, 1990), *Twilight Zone: The Movie* (Livingstone & Livingstone, 1998), and *The Age of Innocence* (Ross, 1996), respectively. Serey (1992) maintains that visual imagery is preferred by students over traditional methods of passive or lecture learning; consequently, he uses the movie *Dead Poet's Society* to enhance understanding of management and organizational behavior. He also proposes that films can serve as a useful complement to traditional finance courses involving challenging technical material.

The degree to which finance films have been used in the classroom to enhance the learning process of finance majors is limited. Specifically, five films have been used to improve students' understanding of primary finance topics generally related to the broad fields of investments, corporate finance, and financial institutions. Two of these films, *Barbarians at the Gate and Enron: The Smartest Guys in the Room*, are based on real-world events while the remaining three, *It's a Wonderful Life, Wall Street*, and *Other People's Money*, are not. The studies focused on these films (Belden, 1992; Chan, Weber, & Johnson, 1995; Dyl, 1991; Graham & Kocher, 1995; Hatfield & Buchko, 2008; Kester, 2013; Nofsinger, 1995; Peterson & Philpot, 1997; Philpot & Oglesby, 2005) provide guidance on how to use various sources such as magazines, newspapers, books, journals, cases, annual reports, substitute films, interviews, and audio tapes to improve understanding and performance in an oral and/or written case format (or capstone corporate finance project) at the undergraduate and/or graduate levels. Further, these studies provide valuable insights on student perceptions, the timing of movies during the semester, and the timing and substance of probing questions used to stimulate student participation and interest.

While these five films can be effectively used in fostering financial education, they are but a small sub-set of the films available to educators. The purpose of this paper is to compile a comprehensive list of useful films covering a variety of finance-related topics. We first provide a brief summary of the 26 films and follow that with information on the time segment within the movie that most easily identifies a primary finance topic for an instructor to cover. For these identified topics, we provide definitional, conceptual and leading questions instructors can build on and personalize to meet their specific learning objectives. Although generic answers to these questions, compiled from various sources, are available from the authors on request, instructors are encouraged to tailor the discussion based on their specific provide context.

Financial Concepts in Film

In Table 1 in Appendix A we list the 26 films which have finance-related content. For each film, the finance topical areas relevant to the film are indicated. The topical areas covered include agency theory/costs and conflicts of interest

(16 films), bankruptcy (12 films), corporate takeovers (10), ethics (26), fraud, illegality, SEC violations (19 films), information asymmetry (11 films), and social responsibility (14 films). Films with the greatest diversity of financial concepts covered include *Barbarians at the Gate* (10), *Inside Job* (10), *Rollover* (13), and *Wall Street* (12). Table 1 will allow instructors to decide on the nature and extent to which these films can complement their course content and discussion.

Barbarians at the Gate (1993)

Dismayed over the low price performance of the RJR Nabisco's stock and the likely failure of the company's smokeless cigarette, the lavishly spending CEO F. Ross Johnson learns from Kohlberg Kravis Roberts & Co (KKR) how he could take the firm private through a leveraged buyout (LBO). Johnson decides to approach RJR Nabisco's Board of Directors directly with a secret bid to be financed by one of KKR's competitors. When the bid is leaked to the public, an enraged Kravis decides to enter KKR into the bidding process as well as other bidders such as Ted Forstmann from Forstmann Little. The bidding war, encouraged by the Board, went from Johnson's first bid of $75 a share to the final accepted bid of $109 a share.

	Interval	Question
1	5:31-8:52	What is the goal of management often expressed in finance courses? Are lavish corporate parties to watch boxing matches consistent with this goal? What about two executives flying side-by-side in Lear jets? Who bears the cost of such a party and flight arrangements? What are agency costs?
2	10:11-11:07	Are these lavish parties and giving away Gucci watches an investment that will bring value to RJR Nabisco? Do you agree with Johnson's statement that "every penny you think I'm pissing away comes back to us dressed up as a nickel?"
3	11:50-13:10, 15:00-17:50, 18:20-20:05, 30:26-32:35	What is an LBO?
4	11:50-13:10, 15:00-17:50, 18:20-20:05, 30:26-32:35	What is a management buyout?
5	11:50-20:05, 30:26-32:35	What did Henry Kravis mean when he said that "debt can be an asset… debt tightens a company?" Do you agree?
6	23:19-29:25	Should Johnson have mentioned that he was going to buy the company? Is it legal to trade on such information?
7	56:23-56:50	What is a junk bond?

Boiler Room (2000)

Facing discovery by the authorities of the unlicensed casino run out of his apartment, and the disapproval of his lifestyle by his father (Marty, a Federal judge), college dropout Seth Davis joins brokerage firm J. T. Marlin. Seth does well, but J. T. Marlin is investigated by the FBI for fraud associated with "pump and dump" schemes. When Seth realizes the full impact of what J. T. Marlin is doing and the role that he has played in it, Seth seeks to make restitution to one of his particularly harmed customers, as well as work with his father in robbing J. T. Marlin through an illegal IPO scheme. Seth is arrested for violating 26 SEC and NASD regulations, but agrees to work with the FBI, culminating with an FBI raid on J. T. Marlin.

	Interval	Questions
1	12:35-13:00, 59:50-1:01:00	What is the Series 7? Why is it important to obtain a Series 7?
2	12:35-13:00, 59:50-1:01:00	What is the Securities and Exchange Commission (SEC)?
3	36:35-42:20, 1:08:50-1:09:55	What is a two-dollar rip? What is the typical commission paid on the purchase of stock or options? How can a two-dollar rip be paid?
4	1:02:00-1:03:15	What is a prospectus?
5	1:02:00-1:03:15	What is an IPO?
6	1:18:25-1:21:02	What is bridge financing?
7	1:08:45-1:09:50, 1:13:00-1:14:20, 1:18:25-1:21:02	How/why does J. T. Marlin pay out more rips than anybody else and more than allowed by law (5% of sale max)?

Brewster's Millions (1945)

Following the death of his uncle, Monty Brewster is faced with the difficult challenge of spending one million dollars within two months, subject to various conditions, in order to inherit the remaining seven million dollars. These conditions include limits on the amounts given to charity or towards gifts and tips. Further, Monty is not allowed to own any valuable assets or be married. The terms and conditions associated with his uncle's will are strictly confidential, and he cannot reveal anything about this will to his friends or fiancée. Monty ultimately finds that meeting these conditions is quite challenging because his friends attempt to prevent Monty from making unwise financial decisions and many of his attempts to spend money backfire and actually make him money.

	Interval	Question
1	11:45-16:54	Assuming an average annual inflation rate of 3.84 percent between 1945 and 2014, what is $8 million worth today in purchasing power? How much would you have to spend each day over two months to consume all this money?
2	16:48-17:30, 20:01-23:00	Brewster attempts to spend money quickly through a taxi fleet, suites at the Weldon Towers, part of Gotham office building, and salaries to friends and his fiancée in companies yet to be created. Is this a positive NPV project proposal? Does risk-aversion factor into Brewster's decisions? What projects can you think of that involve considerable investment up front?
3	28:58-33:44	Are losses beneficial to a firm that has no income to offset? What is the benefit to a firm that offsets income with losses from elsewhere?
4	28:58-33:44	Is it wise to buy lumber and fuel after prices have dropped? What should be considered?
5	31:30-32:42	What is the law of diminishing returns? Is Brewster correct in applying it to his situation?

Enron: The Smartest Guys in the Room (2005)

InterNorth Incorporated, responsible for production, transmission, and marketing of natural gas, acquired Houston Natural Gas in 1985 to become less attractive as a takeover candidate and to operate the first natural gas transmission network that would extend throughout the United States. Kenneth Lay was named CEO and HNG InterNorth was renamed Enron. In 1987, two of Enron's consistently profitable oil traders were found guilty of presenting false bank records to Enron, diverting corporate profits to personal accounts, manipulating earnings, destroying daily trading records, and probably gambling way beyond their limits. The traders were fired and Lay claimed no knowledge of wrongdoing. With trading no longer profitable, Jeff Skilling, CEO of Enron Finance Corp., employed mark-to-marketing accounting to enable Enron to book subjectively estimated future profits on the day a deal was signed. Even as Enron struggled to stay afloat, it managed to report increasing profits. Off-balance sheet companies were created to hide $30 billion in Enron debt so that CFO Fastow could obtain capital from investment partners backed by company assets.

Enron gained a foothold into the newly deregulated California electricity market through the acquisition of Portland General Electric, and sought to create and exploit arbitrage opportunities associated with the rolling blackouts in California. In 2001, analysts began to challenge Skilling and wondered why Enron could not produce a balance sheet or cash flow statement with its earnings, and the SEC began an examination following a Wall Street Journal article. The

institutionalized, systematic, and creative accounting fraud, severely damaged Enron's auditing firm, Arthur Andersen, and in 2001 Enron declared bankruptcy.

	Interval	Question
1	7:10-8:20	Is buying or selling of company stock by corporate executives illegal? Is the sale of stock by insiders prior to the firm failing illegal?
2	12:30-13:30, 17:30-18:46	How can you lose 10 times your original investment in trading oil futures?
3	12:30-13:30, 17:30-18:46	What are energy derivatives?
4	12:30-13:30, 17:30-18:46	What is an option contract?
5	12:30-13:30, 17:30-18:46	What is a futures contract?
6	12:30-13:30, 17:30-18:46	What is a swap contract?
7	12:30-13:30, 17:30-18:46	What is margin?
8	19:22-21:44	What is mark-to-market accounting?
9	31:57-34:02	What is a pump-and-dump scheme? When companies report quarterly earnings at a level that meets or exceeds expectations, is this evidence of pump-and-dump?
10	36:54-37:24	What is a merger?
11	37:20-38:18	Should employees and investors be well-diversified in their investments? If so, why?
12	49:44-52:45	What is structured finance?
13	17:30-21:43, 35:05-37:00, 40:24-43:00, 49:44-52:45, 1:01:30-	How did mark-to-market accounting and structured finance help lead to the downfall of Enron?
14	1:07:00-1:08:00	What is arbitrage? Are returns above and beyond the norm considered arbitrage? How did Enron create arbitrage opportunities?

Glengarry Glen Ross (1992)

Three salesmen (Levine, Moss, and Aaronow) working in real estate are told that the one salesman with the highest level of sales by the end of the week will be retained. Inferior sales leads are made available to the three salesmen, while promising leads are locked up. Levine privately attempts to bribe Williamson (his supervisor) to obtain promising leads but cannot meet Williamson's demands. Moss reveals his plot to steal the Glengarry leads and sell them to a competitor,

but Aaronow's reluctance is apparent. Following this, the office is broken into and the leads are missing. During police interrogation, Williamson reveals information that ruins a sale; Levine inadvertently reveals awareness of a file incriminating himself for the theft; and Levine identifies Moss as the ringleader.

	Interval	Question
1	6:17-7:10	Is the "law of contrary public opinion" useful for trading and investment decisions? Would Warren Buffet subscribe to this law?
2	1:07:54- 1:08:31	What is cold-calling?

Inside Job (2010)

This documentary initially portrays deregulation and the privatization of financial institutions as the reason for economic problems in Iceland. The film suggests that deregulation led to decisions that nearly destroyed the American economy because it allowed selfishness and greed to flourish. Individuals in key positions of authority and influence were compromised because they stood to gain monetarily in the decisions they made or the input they provided. Examples of conflicts depicted in the documentary include issues related to compensation of mortgage lenders, investment bankers, and analysts; forbearance by government agencies and regulators; securitization of poor quality loans; lax oversight of derivatives trading; lobbying of Congress by special interest groups; failure of the rating agencies and insurance companies in understanding the underlying risks; use of high leverage by financial institutions; executive compensation packages tied to short-term rather than long-term performance; too-big-to-fail policies that encourage risk-taking behavior since firms reap rewards while taxpayers bear consequences; homeowners making false assertions about income and assets; corporate board of directors beholden to the CEO; and researchers paid by entities having a financial interest in the conclusions of the research.

	Interval	Question
1	0:45-5:12	What is deregulation?
2	0:45-5:12	What is privatization?
3	6:42-7:30	What is the IMF?
4	6:42-7:30	What are credit default swaps?
5	12:05-18:29	What is the Glass-Steagall Act? What is disintermediation and how did Glass-Steagall lead to disintermediation?
6	12:05-18:29	What is Regulation Q?
7	12:05-18:29	What is the Graham-Leach-Bliley Act of 1999?
8	12:05-18:29	What is diversification?

	Interval	Question
9	18:28-19:49	What is an internet bubble?
10	21:19-23:04	What are Freddie Mac and Fannie Mae?
11	22:48-27:00	What are derivatives?
12	27:00-31:00	What is securitization? What are collateralized debt obligations (CDOs)?
13	27:00-31:00	What is the Community Reinvestment Act of 1977?
14	27:00-31:00	What are sub-prime loans?
15	27:00-31:00	What is predatory lending?
16	31:00-32:16	What is an asset bubble?
17	32:16-33:39	What is underwriting?
18	35:33-37:22	What is leverage?
19	37:22-39:20	What are credit default swaps?
20	37:22-39:35	What is insolvency?

IOUSA (2008)

This documentary follows former U.S. Comptroller General David Walker as he travels across the country to inform citizens of the unsustainable level of national debt. He shows that America has four serious deficits in the areas of budget, savings, balance-of-payments, and leadership and he explains how these deficits formed and grew over time. Over the 40 years prior to 2008, America ran 35 years of deficits and Social Security surpluses were used to help cover these deficits. By 2030, spending will be completely dominated by Medicare, Medicaid, Social Security and interest on debt, and by 2040, debt-to-GDP will be roughly 244 percent. Walker notes that the current low individual savings rates cannot support increased investment, additional research and development, a stronger economy, and an improvement in our overall standard of living. Although America has been running trade deficits for many years, Warren Buffet points out imports into this country have increased from 5 to 17 percent of GDP over the last 35 years. Over this time, ownership of our wealth by exporting nations has grown considerably, and in 2007, the percentage of foreign-owned debt stood at 44.5 percent.

	Interval	Question
1	4:30-6:00	What is federal debt?
2	4:30-6:00	What is gross domestic product?
3	4:30-6:00	What is a deficit hawk?
4	28:20-34:00	What are home equity loans?
5	28:20-34:00	What is the money supply?

	Interval	Question
6	28:20-34:00	What is leverage?
7	28:20-34:00	What is sound money?
8	28:20-34:00	What is quantitative easing?
9	28:20-34:00	What is a dollar crash?
10	34:00-36:00	What is the Federal Reserve System (FED)?
11	34:00-36:00	What is monetary policy?
12	34:00-36:00	What is fiscal policy?
13	34:00-36:00	What is stagflation?
14	45:00-46:00	What is a trade deficit?

It's a Wonderful Life (1946)

The angel Clarence is assigned the task of convincing George Bailey of the good impact that he has made on the town of Bedford Falls. This is a challenging task as George is faced with bankruptcy and arrest for malfeasance and misappropriation of funds. An unscrupulous competitor has pointed out that George is worth more dead than alive, and this gives George the idea of taking his own life by jumping off a bridge. Clarence recounts George's selflessness in saving his brother Harry from drowning and losing hearing in his left ear as a consequence, preventing an accidental poisoning and enduring the pharmacist's wrath in refusing to deliver medication prepared by the distraught pharmacist, forgoing his ambitious plans to attend college and travel the world to keep the family business (Bailey Savings and Loan) open after his father's death, giving Harry money to go to college, keeping the S&L open through a run by meeting withdrawal demands from his personal resources, and turning down a lucrative job offer to keep the S&L running so that it's reasonably priced services remained available.

	Interval	Question
1	9:00-10:26	What is a bank examination?
2	9:00-10:26	What is a mortgage?
3	15:30-16:35	What is the board of directors?
4	15:30-16:35	What is a building a loan?
5	51:20-59:05	What is a bank run?
6	51:20-59:05	What happens when a loan is called?
7	1:33:45-1:35:35	What is security or collateral?
8	1:33:45-1:35:35	What is malfeasance?

Margin Call (2011)

An employee at a trading firm, Eric Dale, is working on volatility and risk assessment just prior to the firm being downsized. Peter Sullivan, a senior risk analyst, looks at Eric's work that night and realizes that the firm's trading positions have been recently touching unacceptably high volatility levels. The firm's positions are highly leveraged, and it would take but a 25% decrease in the value of these positions to bankrupt the firm. Knowing that its assets are grossly overvalued and that other trading firms are holding similar positions, the firm commits to reducing its position substantially the very next day. The firm is successful in disposing of toxic assets and immediately thereafter begins another round of layoffs while planning to profit from the crisis it initiated.

	Interval	Question
1		What is a margin call?
2	20:55-24:00, 26:22-28:40	What is a VAR model?
3	20:55-24:00, 26:22-28:40	What is the volatility index?
4	20:55-24:00, 26:22-28:40	What does "levered" mean and what does leverage have to do with volatility and value?
5	46:21-55:03	What does MBS refer to?
6	46:21-55:03	What are tranches? What does ratings classification refer to? What is the risk to the firm of holding these assets?
7	1:26:19-1:30:13	What are swaps?
8	1:26:19-1:30:13	What is counterparty?

Other People's Money (1991)

Lawrence Garfield, a corporate raider, has identified New England Wire and Cable Company (NEWCC) as a potential target, and has acquired 12 percent of the stock. NEWCC has low debt and high cash balances, and Garfield believes that NEWCC is undervalued by the market because of poor management. CEO (Jorgenson) rebuffs Garfield's initial proposals and faces off against Garfield in a proxy contest at a shareholder meeting. Jorgenson emphasizes the need of the company to continue intact as a responsible partner providing jobs in the community. Garfield notes that the continuing operations of the company have come at the cost of shareholder wealth, and that the company is being run into the ground. The shareholders vote and award the firm to Garfield.

	Interval	Question
1	7:00-7:30	What is liquidation?
2	14:50-15:30	What is a corporate takeover? What is the difference between a merger and takeover?
3	16:30-17:20	What is a schedule 13D filing?
4	19:00-20:09	What is greenmail?
5	21:40-23:35	What is a standstill agreement?
6	25:00-26:30	What is a tender offer?
7	57:00-58:00	What is a proxy fight?
8	57:00-58:00	What is leverage?

Repo Men (2010)

The Union Corporation manufactures and sells artificial organs (artiforgs) primarily on credit to customers under an agreement that allows the company to repossess artiforgs in the case of default without regard to the health, comfort, or survival of the customer. Remy and Jake are the two of the firm's most skilled repo-men. On an assignment to remove an artiforg from an admired music producer, Remy's defibrillator malfunctions as a result of sabotage, and sends him into a coma, requiring his own heart to be replaced by an artiforg. After this incident, Remy loses his desire to work as a repo-man. The lack of income soon leads Remy to default on his debt obligation and to flee from The Union.

	Interval	Question
1	0:00-5:05	What is collateral? What is a lien?
2	0:00-5:05	What is foreclosure?
3	0:00-5:05	What is bankruptcy?

Note: Instructors could show only the beginning of the movie prior to discussing the questions.

Risk (2000)

Ben Madigan, a newly hired adjustor at UAI under the tutelage of veteran adjuster John Kreisky, soon becomes the best adjustor at the firm, successfully encouraging personal injury claimants to settle for 80 percent. Ben unwittingly becomes an accomplice in repeated insurance scams which are referred to them by their third accomplice, the lawyer Louise Roncali. Initially, Ben thinks he is just doing a routine job and is unaware that John and Louise are perpetrating a fraud. Upon receiving the fake claims referred to him by Louise, John would then settle and issue a company check to the claimant and collect a portion of this money in

kickbacks. John begins a steady flow of cash to Ben that gradually draws Ben into the scams. Louise raises the stakes by concocting a more elaborate personal injury accident that ultimately kills John and forces Ben to identify her as the person responsible for the insurance fraud and John's death.

	Interval	Question
1	5:45-7:05	What is an adjuster?
2	5:45-7:05	What is an insurance claim?
3	21:22-21:48	What is a kickback?
4	29:34-30:15	What is a beneficiary?

Rogue Trader (1999)

This is the story of Nick Leeson, an ambitious investment broker who singlehandedly bankrupted one of the oldest and most important banks in Britain. Nick Leeson makes the most of an opportunity to solve a problem for Barings Bank in Jakarta, and then moves to Singapore to establish Barings' derivatives trading floor and the back-office settlement office. During the first year of operations, he is primarily responsible for trading futures and options on behalf of clients and exploiting arbitrage opportunities. Nick reports large profits to the bank while violating trading rules and covering up losses. With few skilled employees at Barings Bank in Singapore, few controls, and very little supervision, Nick engages in large transactions which result in significant trading losses, which he then attempts to cover through the sale of Nikkei put options to generate 7.78 billion yen in premium income. After an earthquake hits Japan, Nick's large derivative positions forces Baring's into losses and ultimately liquidation. Nick flees Singapore to return to London but is arrested in Frankfurt and sentenced to jail.

	Interval	Question
1	3:36-5:03	What is a tiger economy and when were these economies realized?
2	3:36-5:03	What are the characteristics of emerging market economies?
3	3:36-5:03	Why would emerging market economies appeal to investors and what are some of the downside risks?
4	3:36-5:03	What are bearer bonds? Why would an investor hold a bearer bond? What risks are associated with bearer bonds? Why were the bearer bonds left in Baring's vault?
5	10:40-11:45	What is a futures contract? What contract are Nick and his team trading? What is the "Nikkei"?

	Interval	Question
6	12:25-13:50	What is arbitrage? How did Nick engage in arbitrage?
7	14:00-14:30	What is the difference between initial margin and variation margin?
8	22:09-23:03	What are margin calls/payments?
9	30:46-32:05	What is a call option?
10	30:30-32:30	What is the definition of a bull-call spread? What does Pierre want to do and why is he doing it? What was threatening Nick's business and what did Nick do about it?
11	42:54-44:00	What is "notional" referring to when Nick says "notional trade?"
12	42:54-44:00, 1:08:42-1:10:50, 1:27:45-1:28:41	What is the order that Nick places and what does it reflect? What risk exists with this position? What happens to this position?
13	1:30:25-1:31:29	What is insolvency? What is liquidation?

Rollover (1981)

Charlie Winters, CEO of Winterchem Enterprises, was murdered when he became aware of a secret account used by Arab oil producers to gradually move money out of weakening dollar assets into gold. In a move toward attaining her late husband's position, Lee Winters attempts to secure financing for the purchase of a petrochemical plant in Spain while also seeking to understand the role that the mysterious account numbered "21214" played in her husband's death. Winterchem is a corporate customer of Borough National Bank (BNB). Hubbell Smith arranges $500 million in financing for Lee from the Arabs, but also discovers the plot to slowly move money from Arab Eurodollar accounts into gold through the "21214" account. When confronted by Smith, Maxwell Emery, CEO of First New York Bank explains that the deliberate but legal transfer process is necessary to maintain economic stability. Lee offers her silence about the "21214" account in exchange for better financing terms. The Arabs move their money out of their Eurodollar accounts leading to world economic chaos.

	Interval	Question
1	3:30-6:05	What does "cover short currency positions" mean?
2	3:30-6:05	Note that Maxwell Emory, President of the First New York Bank, orders his firm to come in on the long side of the dollar after the dollar had fallen greatly. What was he thinking?
3	14:57-16:05	What is a foreclosure?
4	16:30-17:05	What is a balance sheet? What is a P&L statement? What is commercial paper?
5	18:05-19:06	What is a commission?

	Interval	Question
6	20:05-22:30	What is R&D?
7	20:05-22:30	What is currency translation?
8	25:00-26:50	What is a private placement?
9	25:00-26:50	What is a joint venture?
10	31:41-32:35	What is a bank examiner/examination?
11	37:00-37:58	What is a contingency?
12	41:40-43:10	What does security mean here?
13	41:40-43:10	What is venture capital?
14	47:25-48:52	What are Eurodollars? What is a rollover?
15	47:25-48:52	What are Eurodollar deposits?
16	54:15-56:30	What are domestic CDs?
17	54:15-56:30	What is liquidity?
18	1:28:00-1:31:55	What is a foreign exchange (FOREX) account?
19	1:28:00-1:31:55	What is the Comptroller of the Currency?
20	1:28:00-1:31:55	What is the Federal Reserve?
21	1:28:00-1:31:55	What is the U.S. Treasury?
22	1:43:30-1:45:10	What are agency (Fannie Mae) bonds?
23	1:43:30-1:45:10	What is commercial paper?
24	1:43:30-1:45:10	What are federal funds?

The Bank (2001)

Jim Doyle is a brilliant mathematician who has harnessed the insights of fractal analysis to accurately predict the movements of the stock market through a computer program referred to as the Bank Training Simulation Experiment (BTSE). Jim contacts Simon O'Riley of Centabank (a leading financial services corporation) to interest him in BTSE. Simon, under pressure from the board of directors to increase corporate returns, aggressively pushes Jim to utilize BTSE for live trading in the markets. Jim eventually perfects his program and convinces Simon and Centabank to take a very large position in the market. However, the market does not turn downward as expected. The investments made by Centabank and the personal investments made by Simon and the board members are totally wiped out. This was the Jim's intent all along as payback for his father's suicide stemming from the bank's foreclosure action.

	Interval	Question
1	1:00-3:00	At the opening when Mr. Johnson is in the classroom, he suggests that money is necessary for three things (car, home, old age). He also claims that if you save $.50 per week every week and double the amount saved per week after every three years, then you will have $727,000 at the end of 25 years. What compound annual rate does it take for this to happen and is this rate reasonable?
2	5:44-6:00	The stock has risen 8% in the past 3 months whereas it rose 16% over the same three months a year ago because 1100 branches were closed and 1/3 of the workforce was let go. Why would the stock price increase with these actions?
3	7:02-8:30	What is fractal theory? What is meant by the "human factor?"
4	38:16-40:00	If a customer borrows from abroad (foreign currency loan) and is responsible for paying back the loan in the lender's foreign currency, what does the borrower want to happen to the value of the foreign currency with which he has to pay back (rise or fall in value)?
5	52:15-54:00	What is the balance of trade? How can you make money on knowing the balance of trade figures before they are released to the public?
6	56:35-58:00	What is the triple-witching hour?
7	56:35-58:00	What are stock index options?
8	56:35-58:00	What are stock options?
9	56:35-58:00	What are stock index futures?
10	56:35-58:00	What is a futures contract
11	1:10:25-1:15:10	What is "off" balance-sheet risk?

The Company Men (2011)

This is a story of various individuals working at GTX Corporation during a recession which leads to cost-cutting and employee downsizing. CEO Jim Salanger wants to protect shareholders' wealth and protect the company from takeover. Bobby Walker is a successful marketing executive who is used to a certain lifestyle; Phil Woodward rose through the ranks from the shop floor; and finally, Gene McClary, the company's number two executive, finds himself opposing Salanger's plans. McClary struggles with the layoffs happening at GTX and challenges Salanger openly about the need for layoffs until he is asked to leave. These executives learn the consequences of unemployment as they compete for lower level jobs with younger individuals.

	Interval	Question
1	2:43-6:02	What is guidance?
2	2:43-6:02	What is a merger?
3	2:43-6:02	What are capital expenditures (CAPEX)?
4	2:43-6:02	What are credit markets?
5	2:43-6:02	What are investment-grade bonds and junk bonds?
6	2:43-6:02	What is commercial paper?
7	2:43-6:02	What is a mortgage pool?
8	2:43-6:02	What are CDO's?
9	32:20-33:14	What is a proxy battle/contest? What is a white knight?
10	41:47-43:00	What is due diligence?

The Corporation (2003)

The Corporation is a documentary that explores the origin and development of the corporate form of business. Corporations are a dominant form of business organization and wield considerable economic, political, and societal influence. The film notes that the corporation was given legal status as a person through a ruling of the Supreme Court on a case involving the 14th amendment guarantee of equal rights to former slaves. The film then explores corporate traits to conclude that corporations display the personality disorders of dangerous psychopaths. The film takes a case-study approach to focus on the harm to workers, human health, animals, and to the environment; to challenge the benefits of private property rights. The film concludes that corporations that have grown as a result of deregulation, privatization, and free trade, and are solely in pursuit of profits, have generally been harmful to society.

	Interval	Question
1		What is a corporation?
2	9:35-12:16	What is limited liability?
3	12:10-13:00	What are stakeholders?
4	1:29:35-1:40:35	What are whistleblowers?

The International (2009)

This film focuses on Interpol agent, Louis Salinger, working with New York District Attorney Eleanor Whitman to investigate the International Bank of Business & Credit (IBBC) for money laundering, terrorism, arms trading, and destabilizing foreign governments. While investigating the assassination of Umberto Calvini,

the Italian chief of a firm that produces missile guidance systems, Salinger and Whitman discover the shoeprint of the assassin and track the shoe and attached leg brace back to New York City. IBBC arranges for the assassin to be killed; but Colonel Wexler, of the former East German secret police, and a key IBBC player, is captured. Wexler decides to help Salinger topple IBBC, but both Wexler and Jonas Skarssen (chairman of IBBC) are killed by the Calvini family when they go to attend a meeting to purchase missile guidance systems from an alternative manufacturer. IBBC reinvents itself as a "clean" bank, while continuing illegal activities under different leadership.

	Interval	Question
1	7:35-10:00	The International Bank of Business & Credit (IBBC) is claimed to be involved in money laundering. What is money laundering?
2	42:45-44:30	What are basis points? What does "medium of exchange" mean?
3	1:04:00-1:04:15	What is a kickback?
4	1:36:30-1:38:20	What is insolvency?

The Pursuit of Happyness (2006)

Chris Gardner and his wife Linda invest their life savings into the purchase of portable bone-density scanners, hoping to successfully market them to doctors as a replacement for x-ray machines. However, the scanners sell very slowly and the financial stress ends up tearing the couple apart. Jay Twistle, manager of Dean Witter Reynolds (DWR), gives Chris an opportunity to interview for an unpaid internship with DWR. Chris has custody of his son and the two rely on restrooms, shelters, hotels, charity, and the sale of the few remaining scanners, to meet their expenses. At the conclusion of the internship, Chris is offered a position at DWR, and he uses this experience to eventually start his own brokerage firm.

	Interval	Question
1	57:30-59:12	What are Fortune 500 firms?
2	57:30-59:12	What is cold calling?
3	57:30-59:12	What are commissions?

Note: The instructor may wish to use only parts of the movie to establish context.

The Secret of My Success (1987)

Recent college graduate Brantley Foster arrives in New York City to find that his position has already been eliminated in an acquisition. Brantley then finds employment working in the mailroom of Pemrose Corporation. Howard Prescott,

Brantley's uncle, is CEO of Pemrose and is married to Vera Pemrose. Brantley makes use of the information constantly streaming through the mailroom to learn about the firm and identify ways to improve the firm's operations. During this time, he assumes the role of a fictitious newly hired executive-level employee named Carlton Whitfield. In this role, Brantley finesses his way into top-level meetings tasked with the objective of preventing the takeover of Pemrose by Davenport Corporation. Brantley is able to arrange financing for Vera Pemrose to build a controlling interest in Pemrose, and initiates a hostile takeover of Davenport Corporation by Pemrose Corporation. Vera Pemrose divorces Howard and makes Brantley CEO of Pemrose.

	Interval	Question
1	5:00-5:36, 37:15-39:33	What is a hostile takeover?
2	48:45-51:45	What is a 13-D form?
3	1:40:00-1:42:35	What is a proxy fight?

There Will Be Blood (2007)

Daniel Plainview is a miner who reinvents himself as an oilman after discovering crude oil in a silver mine. He starts his own drilling company, adopts the son of a dead coworker as his own son, and becomes a reasonably successful New Mexico oil producer. A few years later, Daniel learns of oil seeping from a property in Little Boston, California, and travels to California to learn that oil came to the surface after a recent earthquake. Daniel successfully negotiates with the Sunday family to acquire the drilling rights. He also acquires additional land for drilling and for the construction of a pipeline to transport oil. Daniel is ruthless and unethical in his business dealings, and engages in intimidation, violence, and criminal behavior to achieve his goals. Daniel's business grows in profitability and he becomes very wealthy, but his remaining days are filled with growing bitterness and hatred as his relationships with his son and the community continue to decline.

	Interval	Question
1	19:45-25:00	How much is information worth? How do you put a price on information? What would you pay the boy for this specific information? What does it mean to say that markets are informationally efficient?
2	30:53-36:30	What is the difference between oil and quail prices? Are product/commodity (oil) markets efficient at this point in time?

Too Big to Fail (2011)

This documentary chronicles the players and events related to the financial crisis of 2008. The documentary links the deregulations from the 1980s and 1990s, the increasing interaction between investment and commercial banking, and the legislative push toward home ownership, to the bubble in real estate prices. The subsequent crash of the real estate markets left large investment bankers holding non-performing mortgage-related assets, driving them toward bankruptcy. Bear Stearns was the first casualty and was sold to J. P. Morgan for $2 a share. Freddie Mac and Fannie Mae, two government-chartered but privately-owned corporations, came close to insolvency, and were placed in conservatorship. Bank of America, after acquiring Countrywide, was not interested in purchasing Lehman Brothers, but instead acquired Merrill Lynch. After several failed purchase offers, Lehman had to file for bankruptcy.

During this difficult period, credit markets were frozen and even large businesses like General Electric and Goldman Sachs had difficulty obtaining funding for operations, and depositors at banks and brokerages began pulling money out of the markets. Further, the primary insurer (AIG) guaranteeing payment on the toxic mortgage-related securities held by investment banks and pension funds was on the verge of bankruptcy. Without a government bailout of $85 billion, AIG would not have been able to continue operations, which would have caused even more pain in the financial system. In order to preserve the financial system, the U.S. Treasury Department considered all possible options, and provided guarantees and large amounts of financing, both directly and indirectly, so as to improve liquidity in the financial system, and to motivate lenders to continue making business and individual loans.

	Interval	Question
1	1:36-2:00	What is a mortgage?
2	4:20-5:15	What is short selling?
3	4:20-5:15	What does it mean to raise capital?
4	5:15-6:07	What is a bailout?
5	7:15-10:22	What is a line of credit?
6	7:15-10:22	What are preferred shares?
7	7:15-10:22	What is “the street?”
8	7:15-10:22	What is a bank run?
9	13:55-15:10	What does the term “solvent” mean?
10	17:10-19:15	What are Fannie Mae and Freddie Mac?
11	17:10-19:15	What is default?
12	17:10-19:15	What are capital requirements?

	Interval	Question
13	17:10-19:15	What are risk-based capital requirements?
14	26:55-28:00, 51:10-51:30	What is moral hazard?
15	28:31-31:15	What are toxic assets?
16	28:31-31:15	What are mortgage backed securities (MBS)?
17	28:31-31:15	What are collateralized debt obligations (CDOs)?
18	28:31-31:15	What are credit default swaps (CDS)?
19	53:08-55:40	What is a downgrade?
20	53:08-55:40	What is financial exposure?
21	53:08-55:40	What is short selling?
22	1:00:33-1:02:32	What are credit markets?
23	1:03:20-1:05:00	What is a bank run?
24	1:27:50-1:28:42	What is preferred stock?

Trading Places (1983)

Louis Winthorpe III is a successful employee working for Randolph and Mortimer Duke, owners of commodities brokerage firm Duke and Duke. Randolph and Mortimer debate whether genetics or environment (nature vs. nurture) is the primary influence on human development, and use Winthorpe and Billy Ray Valentine (a con artist and street bum) in an experiment without their knowledge. Through the manipulations of Randolph and Mortimer, Louis loses his job, home, money, and credit cards to Billy Ray; and privileged Louis and hustler Billy Ray find themselves swapped into every aspect of the other's very different position in life. Billy Ray performs admirably with Duke and Duke, while Louis slips into the life of a street hustler. One day, Billy Ray learns of Randolph and Mortimer's role and informs Louis, and together, they plot to bankrupt Duke and Duke. Randolph and Mortimer become aware of an expected shortfall in the orange crop production and immediately take huge long positions in frozen concentrate orange juice futures contracts, causing prices to jump and rise steadily. Louis and Billy Ray enter sell positions, and after the government announces that a normal orange crop production is expected, prices drop quickly. At the close, Randolph and Mortimer Duke have substantial losses and have to come up with almost $400 million to meet a margin call, while Louis and Billy Ray walk away with substantial profits.

	Interval	Question
1	9:54-10:46	What is stagnation?
2	56:10-57:55	What does it mean to speculate in commodities? What are commodities? How do traders make money?
3	56:10-57:55	What does the Duke brothers' business do? How do the Duke brothers make money?
4	1:01:00-1:02:55	What does "go long" mean?
5	1:06:15-1:07:00	Why did Louis have to sell his watch at a severe discount?
6	1:06:15-1:07:00	What are imperfect markets and do they exist?
7	1:06:15-1:07:00	Was all relevant information priced into determining the final price of the watch?
8	1:25:07-1:27:05, 1:37:35-1:38:50	What does it mean to "corner the market?"
9	1:25:07-1:27:05, 1:37:35-1:38:50	What is "inside information?"
10	1:25:07-1:27:05, 1:37:35-1:38:50	What is "insider trading?"
11	1:41:00-1:51:00	What is a futures contract?
12	1:41:00-1:51:00	What are the "pits?"
13	1:41:00-1:51:00	Why are the Dukes going to buy strongly when the exchange opens?
14	1:41:00-1:51:00	What total price does 102 reflect?
15	1:41:00-1:51:00	What is Winthorpe trying to do?
16	1:41:00-1:51:00	Once the futures price hits 45, what does Winthorpe do?
17	1:41:00-1:51:00	What did Winthorpe make per contract assuming a sell at 142 and a buy at 29?
18	1:41:00-1:51:00	What is a margin call?

Wall Street (1987)

Bud Fox, an ambitious stockbroker at Jackson Steinem & Company, has an opportunity to meet Gordon Gekko, a highly successful corporate raider. Bud provides Gekko with inside information that the Federal Aviation Administration will soon absolve Bluestar from blame in a recent accident, and Bluestar will be able to resume flights. Gekko profits from this transaction and encourages Bud to continue to provide him with private information. Bud follows Sir Lawrence Wildman (another corporate raider) and learns that he intends to take control of major steel company, Anacott Steel. Gekko takes a large position in Anacott Steel before Wildman is able to acquire a controlling interest, and profits from the greenmail that Wildman pays him to sell the shares.

Bud masquerades as a maintenance worker by night to explore various businesses and continue his quest for inside information. Bud persuades Gekko to buy Bluestar, obtain concessions from the unions, compete with major carriers, and make Bluestar a success. Gekko agrees but secretly plans to sell the assets, leaving the staff unemployed. Bud is distressed by this turn of events, and convinces Wildman and other customers at Jackson Steinem to invest in Bluestar before Gekko can acquire the airline. Gekko cuts his losses and pulls out of Bluestar but instigates an SEC enquiry into Bud's trading from an offshore account. Bud cooperates with the federal authorities to obtain evidence of Gekko's illegal activities as part of a plea deal.

	Interval	Question
1	3:00-3:45	What is an IPO?
2	3:00-3:45	What is the gold standard?
3	7:52-8:55	What does sell short mean?
4	7:52-8:55	What are investment bankers?
5	12:10-13:20, 19:00-21:00, 22:45-25:22, 31:10-36:55	What is insider information?
6	12:10-13:20, 19:00-21:00, 22:45-25:22, 31:10-36:55	Should the information about the FAA investigation into the Bluestar accident be considered insider information?
7	12:10-13:20, 19:00-21:00, 22:45-25:22, 31:10-36:55	Did Bud Fox and Gordon Gekko break insider trading laws?
8	15:55-16:25	What is preferred stock?
9	15:55-18:00	What is a merger?
10	15:55-18:00	What are junk bonds?
11	19:00-21:00	What is float?
12	19:00-21:00	What is a five-point pop?
13	19:00-21:00	What is a tender offer?
14	19:00-21:00	What is a 13-D?
15	21:40-22:00	What is cold calling?
16	33:25-35:00	What is a white knight?
17	33:25-35:00	What is the SEC?

	Interval	Question
18	37:10-40:45	Bud Fox observes the movements of Larry Wildman and reports this information back to Gekko. Bud and Gekko use this information to determine what Wildman is doing in the takeover market and they trade on this analysis. Is this considered inside information and trading on inside information?
19	37:10-40:45	What are July 50 calls?
20	48:55-52:42	Did Gekko do well with Anacott Steele?
21	48:55-52:42	What is greenmail?
22	48:55-52:42	What are capital reserves?
23	1:13:55-1:04:03	What does limit 26 mean?
24	1:14:44-1:19:30	What is leverage?
25	1:14:44-1:19:30	What is a golden parachute?
26	1:14:44-1:19:30	What are Eurodollar CDs?
27	1:32:25-1:34:20	What is a revolving line of credit?
28	1:32:25-1:34:20	What is liquidation?
29	1:32:25-1:34:20	What is an annuity?

Wall Street: Money Never Sleeps (2010)

Gordon Gekko is paroled after serving seven years of an eight year prison sentence for insider trading and securities fraud. Jacob Moore, a trader for Keller Zabel Investments is seeking $100 million in additional funding to enable United Fusion Corporation (UFC) to continue development of clean energy technology. As the 2008 financial crisis develops, Keller Zabel is unable to obtain government financing support partly because of opposition from Bretton James, CEO of Churchill Schwartz. A few years prior, James had provided key evidence that ensured Gekko's conviction on securities fraud, and has now spread information about the toxic assets carried by Keller Zabel. With liquidity and traditional sources of financing drying up during the crisis, Moore scrambles for alternative sources to help UFC. Moore informs Gekko that he is engaged to Gekko's daughter, Winnie. As their relationship grows, Moore seeks to reconcile the relationship between Winnie and Gekko, and Gekko strives to end Bretton's career. After Moore causes losses to Churchill Swartz, James offers Moore a job at Churchill Swartz, which Moore accepts with the intention of avenging for Zabel's suicide. Moore learns of an overseas $100 million trust account that Gekko had set up for Winnie, and convinces her to release the money. Gekko absconds to London with this money and takes advantage of the dramatic market movements to grow the $100 million to over $1 billion.

	Interval	Question
1	8:25-9:54	What does nationalize mean?
2	8:25-9:54, 57:25-58:00	What is a bubble?
3	14:25-23:02	What are defaults? What is sub-prime debt? What does off-balance sheet mean? What is leverage? What is a commission? What is a correction? What is a margin? What is liquidity? What is investment banking? What is equity? What is rollover? What is a bailout? What is moral hazard?
4	28:40-29:40	What is due diligence?
5	30:15-35:00	What are collateralized mortgage obligations (CMOs), collateralized debt obligations (CDOs), structured investment vehicles (SIVs), and asset-backed securities (ABSs)?
6	46:00-47:58	What is a bridge loan?
7	46:00-47:58	What is a perpetuity?
8	1:12:40-1:13:50	What is a non-profit?
9	1:13:55-1:15:50	What is a bear market?
10	1:13:55-1:15:50	What are insurance swaps or, rather, credit default swaps?
11	1:21:20-1:26:00	What is the "too-big-to-fail" policy?
12	1:21:20-1:26:00	What are money markets?
13	1:32:50-1:37:43	What is hedging?
14	1:32:50-1:37:43	What is insolvency?
15	1:32:50-1:37:43	What is a trust?
16	1:32:50-1:37:43	What is money laundering?

Working Girl (1988)

Tess McGill is a hard-working woman who took night classes at a local university to obtain a bachelor's degree in business. Tess works at Petty Marsh, as secretary to financial executive Katherine Parker, who encouraged Tess to share any business ideas she might have. Tess has the drive to rise to an executive position, and trusting Parker, reveals her ideas to save a large company (Trask Industries) from a foreign takeover. Tess suggests that Trask Industries should expand by acquiring a radio network rather than a television network because it would be easier and safer, and radio stations are protected by the Federal Communications Commission from foreign takeover. Tess later discovers that Parker was proceeding with her merger suggestion as if it were her own, and that she was unlikely to receive any credit for the idea. Tess then teams up with Jack Trainer, a mergers and acquisitions executive at Dewey Stone, and together, they

successfully pitch the merger idea to Orrin Trask. Trask is impressed by Tess's passion, integrity, and ambition, and offers her a good position at Trask Industries.

	Interval	Question
1	4:32-6:33	What does "go short" mean?
2	4:32-6:33	What is arbitrage?
3	12:06-12:30	What is a merger?
4	12:06-12:30	What is an acquisition?
5	14:22-14:30	What is "tender?"
6	18:25-18:41	What is divestiture?
7	19:35-21:02	What is the SEC?
8	45:50-47:27	What is an acquisition?
9	45:50-47:27	What is a hostile takeover?
10	45:50-47:27	What is the FCC?
11	45:50-47:27	What is a balance sheet?
12	45:50-47:27	What is a stock repurchase program?
13	49:58-50:47	What is a board of directors?
14	1:13:00-1:15:00	What is a bidding war?

Suggestions for Additional Discussion and Conclusions

We reviewed various documentary and commercial films for business and finance content and specifically identified 26 films with interesting and relevant finance content. We then identified specific finance topics within these films that instructors may find useful as supplemental visual aids for students to gain deeper context and understanding of the theoretic constructs which are set-up in the classroom setting. For example, if an instructor is covering arbitrage in class, he will find that arbitrage is of focus in *Enron: The Smartest Guys in the Room*, *Rogue Trader*, and *Working Girl* at the 1:07:00-1:08:00 and 12:25-13:50 and 4:32-6:33 segments, respectively. Thus, instructors can readily identify the film and film segments that would be of practical use in class in an effective manner. We have also suggested questions to accompany each of the identified films.

The films can be used to create an innovative stand-alone finance case course, or may be used to complement existing courses. While it is evident that the material can be used in an Investments course, the material can also be used to discuss financial markets and institutions. Some of the films are 20+ years old and can be used to discuss changes in regulations over time. Some films were made during the financial crisis and can be used to chronicle the circumstances at the beginning of the crisis, with follow-up discussion on the regulatory and private sector response to the crisis. Some films, for example, *It's a Wonderful Life*, can be used in a

Bank Management course to discuss how the banking industry has changed and situations which may (or may not) happen today. Some of these films could even be used in courses other finance, for example, *Enron: The Smartest Guys in the Room*, could be used in accounting and business law courses to discuss events that led to the creation of the Sarbanes-Oxley Act. The films portray commonly held perceptions about the role of finance in the economy and the ethical dimensions of finance, but we leave that as a topic for a later paper.

With the number of films and topics reviewed in this paper, finance instructors have many options to supplement their course materials with interesting and educational film content. The use of films (or film segments) in the classroom can be enjoyable to both the instructor and the students, though we do caution that the synopsis does contain spoilers, and the content may not be suitable for all audiences.

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Appendix A: Table 1: Relevant Areas of Topical Coverage Introduced in 26 Finance Films

	Film	Agency Theory/Costs, Conflict of Interests	Bankruptcy	Capital Budgeting	Capital Structure	Corporate Governance	Corporate Restructuring	Corporate Takeovers	Ethics	Fraud, Illegality, SEC Violations	Information Asymmetry	Trading (legal and illegal insider)	Social Responsibility	Time Value of Money/ Valuation	Leveraged Buyouts	Derivatives, FX	Asset Allocation / Portfolio Diversification	Deregulation/regulation	National Debt, Balance of Trade	Financial Intermediation	Insurance	Total
1	Barbarians at the Gate	X		X	X	X	X	X	X		X	X			X							10
2	Boiler Room	X							X	X	X	X										5
3	Brewster's Millions			X					X			X		X								4
4	Enron: The Smartest Guys in the Room	X	X						X	X	X	X				X	X	X				9
5	Glengarry Glen Ross	X							X	X												3
6	Inside Job	X	X			X		X	X	X	X		X			X		X				10
7	IOUSA		X						X	X			X						X			5
8	It's a Wonderful Life		X						X	X			X							X		5
9	Margin Call	X	X			X			X		X		X			X						7
10	Other People's Money					X	X	X	X				X									5
11	Repo Men		X						X	X			X									4
12	Risk	X							X	X	X		X								X	6

13	Rogue Trader	X	X						X	X		X				X					6
14	Rollover	X	X			X	X	X	X	X	X	X	X			X			X	X	13
15	The Bank	X	X			X			X	X	X		X							X	8
16	The Company Men	X				X	X	X	X				X				X				7
17	The Corporation								X	X			X					X			4
18	The International	X							X	X											3
19	The Pursuit of Happyness								X												1
20	The Secret of My Success					X		X	X	X											4
21	There Will Be Blood	X							X	X	X		X								5
22	Too Big to Fail	X	X		X		X	X	X	X			X					X			9
23	Trading Places								X	X	X	X				X					5
24	Wall Street	X	X		X	X	X	X	X	X	X	X	X			X					12
25	Wall Street: Money Never Sleeps		X				X	X	X	X		X						X		X	8
26	Working Girl	X						X	X									X			4
	Total	16	12	2	3	9	7	10	26	19	11	9	14	1	1	7	2	6	2	4	1

Understanding Basis through Grain Hedging

Thomas B. Sanders
University of Miami

Derivatives taught in modern Finance programs at major universities usually focuses upon options and swaps on equities, debt, and foreign exchange as the primary markets that graduates will work in at the major money markets of the world; futures might be included merely for purposes of completeness. Yet, with the advent of commodity investment funds, there is a growing need to study agricultural futures since these are the primary instruments of hedging used by farmers and ranchers in laying off price risk for crops and livestock on the ground. Being the most liquid derivative on farm goods due to usage, the futures contract becomes the primary investment vehicle for commodity speculative bets. So, the study of agriculturals now becomes important. Understanding agricultural futures requires a reasonable knowledge of basis since historical basis studies is the foundation of crop hedging. In addition, by studying basis in agricultural futures, the student develops a greater understanding of futures on the more traditional financial spot markets, and can better manage the commodity investment fund.
Keywords: *agricultural futures, agricultural options, cost of carry, futures spread, agricultural margins*

Introduction

Textbooks used for delivery of a course in speculative markets in a Finance curriculum typically have focused heavily upon options and swaps for equities, bonds, and foreign exchange since these are the markets graduates would most likely encounter while working in investment houses in the world's money markets. So, in the past, futures might have been included only for purposes of completeness.

Now, the commodity investment fund has become a major investment vehicle for speculative bets. Agricultural hedging have traditionally involved futures markets as the most liquid and favorite means for farmers to lay off price risk on field crops and livestock. So the finance student increasingly needs to understand agricultural futures.

To wager in commodity derivatives requires a developed understanding of the basis, the spread between the futures and spot price. The contract is said to

be in contango when the size of the futures prices dominates the spot, with the implication that the spot price is expected to move up over time. Yet such a simple interpretation ignores the great complexities in futures pricing that are not often taught as the derivatives course draws to a close.

Farm and ranch hedgers make great use of historical basis studies in deciding which contact will best mitigate their price risk exposure. The practitioner use of historical basis studies is probably rarely taught in traditional Finance programs.

Moreover, it is asserted that the study of basis in agriculturals serves to deepen the understanding of the more traditional futures markets in equities and bonds.

Thus, this paper provides an introduction to the process of grain hedging as a means of enhancing one's understanding of futures contracts and basis.

Teaching Basis through Agricultural Futures

Several good textbooks teach futures and options, including Chance and Brooks (2016), Kolb and Overdahl (2006), and McDonald (2006), among others. As an example, let us look at Hull, *Fundamentals of Futures and Options Markets* (2013)**.** As is typical in derivatives textbooks, the author has a chapter on futures and forward pricing theory. And, he also has a chapter "Hedging Strategies Using Futures." It is in this latter chapter where I believe we can help out.

Professor Hull goes through fundamental hedging and basis risk and then gives a portfolio hedging example using equities index futures. My suggestion is to add substantially to this chapter by introducing the whole universe of the agricultural derivative world, mentioning that this now becomes important to the Wall Street because of the mainstreaming of commodity investment funds. In this add-on, the student gains a much deeper understanding of the basis in futures contracts, which enhances the understanding of interest rate and equities futures. In this paper, I show numerous problems involving agriculture futures, with the attendant answers and explanations, which could be added to the end of chapter questions.

One does also have to keep in mind that the agricultural economists who teach ag econ majors tend to use our standard derivatives books might appreciate this add on.

The Literature

For those wanting to get into the futures literature, an excellent generalized earlier review was provided by Kamara (1982). A more specific review of livestock futures in the 1970s was provided Leuthold and Tomek (1979). Another period review of literature up to the 1980s was provided by Carter (1999), and Williams (2001). Tomek and Peterson (2001) looked at risk management articles, while Andreau et al (2001) focused on speculative prices. Chen et al (2003) and Lien

and Tse (2002) looked at futures hedge ratios. A more recent review of literature was provided by Garcia and Leuthold (2004).

While not trying to add to this futures theory literature, the approach provided in this paper is to demonstrate the practice of futures hedging and speculation used by real world farmers, ranchers, and food processors. The contribution of this article is to provide a deeper understanding of the basis of futures contracts through the use of exercise problems on hedging grain futures.

The Tutoral

Hedging of foodstuffs in the Chicago Board of Trade futures trading pits dates back to the 1920s, representing a deeply liquid insurance market for agricultural price exposures. Agricultural options came much later.

The tutorial takes us through the principles of basis and basis studies, farmer- and institutional-buyer hedging, agricultural cost of carry and full carry, purchase agreement, grain options, option spreading, writing grain options for income, delta hedging with grain options, combination options on grains, selling or storing decisions, and basis strengthening and weakening.

A number of extensive homework problems with detailed answers are provided in the appendix to this paper for those wanting to exercise their knowledge of commodity derivatives.

The following material assumes that readers have been exposed to basic option and futures theory, including futures options, option pricing, deltas, Black Scholes. So, this exposition serves to illustrate applications of basic futures and options theory to the agricultural sector.

Basis

Basis is a key concept of futures contracting. If soybeans in the cash or spot market today on August 1 sell for $6.00/bushel and in the futures market for $5.75/bushel, we say that the basis *is 25* cents ***over*** since basis is defined as the spot rate minus the forward rate. That is, the cash price is 25 cents over the near contract futures price. We say also that the basis is ***positive.***

The higher cash price at a destination such as a gulf port could mean that the gulf port is a longer distance from the central growing areas of soybeans than the national average, represented by the futures price, such that larger transport costs make for the higher cash price. Thus, while Gulf corn tends to have a positive basis, central Iowa corn (being closer to the growing areas) might have a negative basis.

One could easily see basis move from positive to negative when conditions change and there is currently a greater abundance of commodity at the destination

port than on the average nationally, driving down the cash price to be under the futures prices.

Basis Studies

What is usable in agricultural hedging is not the 25 cents over based upon the current spot price for soybeans, shown above, but the historic basis taken from basis studies. Table 1 shows basis study for Gulf soybeans from 1989 to 1993 by each week of the 52 week year.

If a soybean farmer normally harvests his crop in the third week of October, week 43, he would compare rainfall and temperature conditions this year to various conditions for each of the years in the table, and choose one year that is most similar, perhaps in 1991. So he chooses a historic basis of 39.75 over. That is, the cash price this year in week 43 is expected to be 39.75 cents over the nearest futures contract, November, which currently trades at perhaps $5.75/BU.

Table 1: Basis Study of Soybeans

Table shows positive cents/bushel over the near futures contract. The various numbers demonstate differing demand-supply conditions for various weeks throughout the year, over various years. Thus, if one were planning to buy soybeans in week 9, he would look for a year that had weather patterns similar to the present year.

week	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	avg	min	max
1	18.25	37.88	25.00	32.13	25.85	23.63	37.38	47.08	37.56	25.40	31.01	18.25	47.08
2	19.20	34.95	28.25	29.81	27.85	26.81	47.25	51.63	38.50	28.20	33.25	19.20	51.63
3	21.81	34.25	30.45	28.13	27.31	29.30	49.00	50.90	39.40	31.25	34.18	21.81	50.90
4	22.35	34.20	29.50	28.20	29.92	31.71	48.45	43.35	37.70	31.65	33.70	22.35	48.45
5	26.80	34.65	33.05	29.25	29.10	30.85	43.60	43.65	38.33	28.60	33.79	26.80	43.65
6	32.94	37.05	34.40	30.00	28.38	30.44	41.95	44.20	36.20	27.50	34.31	27.50	44.20
7	39.50	36.95	34.38	29.00	29.88	31.75	43.05	42.86	34.13	30.35	35.18	29.00	43.05
8	44.44	37.56	33.94	31.15	29.95	32.50	43.50	38.63	34.60	29.60	35.59	29.60	44.44
9	35.50	34.63	35.40	32.88	24.25	28.35	36.65	39.70	35.33	24.06	32.67	24.06	39.70
10	31.65	22.40	22.45	22.10	25.00	27.55	30.55	33.75	29.80	27.88	27.31	22.10	33.75
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39	28.95	19.80	33.90	32.00	27.30	25.00	33.90	46.88	56.80	28.15	33.27	19.80	56.80
40	26.55	18.30	34.05	28.75	22.10	25.05	33.90	34.10	41.20	30.90	29.49	18.30	41.20
41	27.85	21.15	36.45	27.85	23.00	24.90	35.60	35.60	37.00	26.10	29.55	21.15	37.00
42	29.55	21.20	36.95	25.75	22.45	26.55	37.05	36.35	34.10	28.30	29.83	21.20	37.05

Table 1: *(continued)*

week	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	avg	min	max
43	36.20	21.15	39.75	27.50	24.71	27.63	39.35	39.80	29.35	28.20	31.36	21.15	39.80
44	34.30	19.50	38.35	25.25	17.05	21.20	39.80	38.58	26.23	25.40	28.57	17.05	39.80
45	28.88	11.69	35.75	22.88	16.42	23.75	36.43	37.95	23.38	23.50	26.06	11.69	37.95
46	30.90	19.69	34.00	23.00	19.60	30.50	35.10	37.30	27.20	25.70	28.30	19.60	37.30
47	32.00	22.08	32.70	20.35	21.17	32.00	37.72	37.70	26.70	28.08	29.05	20.35	37.72
48	32.85	26.70	34.75	28.00	24.60	36.25	37.90	37.81	26.19	27.50	31.26	24.60	37.90
49	36.70	27.85	34.75	30.05	27.40	40.75	40.05	35.90	28.60	28.50	33.06	27.40	40.75
50	43.40	30.05	32.90	26.55	30.80	42.40	42.35	36.25	29.60	29.60	34.39	26.55	43.40
51	50.10	29.15	34.88	28.25	30.94	41.38	40.00	39.00	27.80	31.60	35.31	27.80	50.10
52	49.92	29.00	33.00	27.83	30.44	44.38	42.28	38.00	28.40	33.40	35.66	27.83	49.92
avg	34.50	23.76	32.50	28.32	25.08	27.60	37.32	34.89	43.94	30.86	31.88	23.76	43.94
min	14.60	7.20	22.45	18.00	16.42	19.20	20.05	18.10	17.56	23.30			
max	55.95	37.88	40.13	37.63	35.15	44.38	49.70	56.30	163.80	50.63			

Adapted from "Understanding Basis," Chicago Board of Trade, 2004.

Let us review the setup before going further.

Crop	Expected sale	Hedge expiry	Begin futures price	Basis studies forecast
Soybeans	October	November	5.75	39.75

The Expected Price

Now in August, the farmer can determine that the price he expects to get when his trucks reach the grain elevator in October will probably be $6.1475/BU, which is 39.75 over the futures price.

Farmer Hedging

But the farmer is not sure about his price, so he hedges with the November futures, going short at $5.75/BU, where his short will cover any price drop less than $6.1475/BU if the basis holds.

If on October harvest day, the November futures contract trades at $5.60, this means that national supplies on the average were more abundant than they were in August, driving down the futures price. Say on harvest day the farmer sells the crop cash for $5.9975/BU (39.75 over the futures price), which is less than the $6.1475/BU he had hoped for. But his hedge works for him since he longs the

futures in 43rd week for $5.60/BU to offset the original short at $5.75/BU, giving him a 15 cent hedge profit. This adds to the selling price, giving him the $6.1475/BU he was looking for.

Playing the Spread

Suppose October comes and the farmer notices that while the November futures price is $5.60, he also sees that January soybeans futures now trade $5.80/BU. This suggests that prices might be rising since the ***spread*** between the two futures contracts is $.20/BU. Should he hold off and store the grain, and roll the hedge forward to the next futures month of January?

He guesses he could sell his crop to the elevator two months later in December for $6.1975/BU (5.80 plus .3975), which is 5 cents higher than the present net sale price after hedge profit in week 43 in October of $6.1475/BU.

However, since the crop was harvested in October, the farmer must store this crop for the additional 7 weeks until mid-December. If the financing and storage costs are assumed to be about $.0021/day/BU, then the cost of carry for the 7 weeks, or about 50 days, is $.105/BU. But he would sell for 5 cents more ($6.1975 in December less $6.1475 in October), assuming the basis holds constant such that the hedge works well. But this spread is not enough for the farmer to store since .05 < .105; so the farmer would sell in October rather than store.

He is making this spread decision in October.

(In the example above, the $.0021/day/BU number shown above is fictitious. Real numbers can be obtained from the CME for each grain. Early in the fall of 2013, the CME provided a rundown for corn. Financing costs are about 200 basis points over the 3 month Eurodollar. At that time the Eurodollar traded at .26%. So the financing costs were 2.26% per annum. Storage costs for corn were about $.00165/BU/day. If the futures price for December corn at that time was $4.88/BU, then the cost of carry for corn for say 91 days is 91*[(.0226/360)*4.88 +.00165] equals $.1780/BU/91 days. This real number for corn, of course, differs from the fictitious number used above for soybeans.)

Forward Purchase Agreements

In August, say a supplier has put forth a direct offer to buy a farmer's soybean crop in October at week 43 at a price of 39.50 over the near futures contract. At the time in August, the November soybeans futures trades at $5.75/BU, so the farmer considers selling at $6.145/BU into the forward purchase agreement.

But if the historical basis from basis studies for week 43 is 39.75 over, the farmer might not take the LT offer since he would sell on his own in the spot

markets at a higher price of $6.1475/BU.

However, what the purchase agreement does offer the farmer is a guaranteed basis of 39.50. Since basis risk is always present, the purchase agreement might still be attractive if the farmer is especially worried about basis risk and would be willing to take a lower price to mitigate this risk.

Keep in mind that forward purchase agreements involve substantial ***production risk*** because they commit the farmer to sell a fixed amount of soybeans. If the crop turns out to be short, the farmer will have to go out into the spot markets to buy the deficiency to make good on his purchase agreement.

Hedging with Grain Options

To exercise the student, we will switch sides now and examine a food manufacturer purchasing wheat commodity sometime in the near future. And we switch the hedge to options. Here is the initial setup for wheat options.

Crop	Expected buy	Futures expiry	Options expiry	Begin futures price	Basis studies forecast
Wheat	November	December	Late November	6.50	10 cents under

This food manufacturer will buy wheat in November when basis studies say the basis will be, say, 10 cents/BU under December futures, which now in August trades at say $6.50/BU. So the buyer expects to buy at $6.40/BU in the cash markets in November.

But the buyer is worried about rising prices, so he buys December calls with a strike price of 650 at a premium of 15 cents/BU as a hedge.

(One must be careful with these dates. Unlike futures contracts, commodity options expire later in the month ***before*** the stated month. Thus, the CBT December wheat option expires around November 23. So the commodity purchaser must be sure he is buying in the spot markets in early November.)

Keep in mind that the hedger rarely exercises the option but instead simply sells the call in November at crop purchase time; if wheat prices rise, the hedger makes a capital gain on the sale of the call which is supposed to offset any purchase price above $6.40/BU. Therefore, the hedger always purchases his physical wheat in the cash markets and will not normally exercise his call to source his wheat.

So how does this settle up? If in November, the December futures trades at $7.50/BU, the intrinsic value of the call should move from $0.15/BU to about $1.15/BU, and can be sold for a $1.00/BU profit. Meanwhile, the food manufacturer buys wheat at $7.40/BU ($0.10/BU below the futures price, assuming the historical basis held). So, the hedge profit of $1.00/BU offsets the higher purchase price, and

gives the commodity purchaser the net purchase price of $6.40/BU that he had hoped for. Here is a summary.

	Futures	Cash price	Option hedge
August	$6.50	$6.40	-$0.15 Buy
November	$7.50	$7.40	+$1.15 Sell
Profit/loss		-1.00	+1.00

Note that the original option purchase price of $0.15/BU spent by the hedger was recouped when the option was sold in November for $1.15/BU.

Had the buyer hedged with a long December futures, he would have an identical result.

	Cash price	Futures hedge
August	$6.40	+$6.50 Long
November	$7.40	-$7.50 Short
Profit/loss	-$1.00	$1.00

The option provides an advantage when the cash price drops instead of rising. Say the futures price in November is $5.50/BU instead of $7.50/BU, causing the buyer to save $1.00/BU on the actual cash purchase. Being out of the money, the call option is left to expire, and the hedger absorbs the $0.15/BU option premium. This leaves a net purchase price on wheat in November of $5.55/BU when one adds the option purchase to the actual cash buy, which is summarized as

	Futures	Cash price	Option hedge
August	$6.50	$6.40	-$0.15 Buy
November	$5.50	$5.40	
Profit/loss		$1.00	-$0.15

Whereas if the hedger had hedged with a long wheat futures, his result would have been a net purchase price of $6.40/BU when one adds the hedge leg loss to the actual purchase price of $5.40/BU.

	Cash price	Futures hedge	
August	$6.40	-$6.50 Long	
November	$5.40	+$5.50 Short	
	Profit/loss	$1.00	-$1.00

So, with the option the wheat buyer gains the advantage of not having the hedge leg loss offset the cash leg gain, as happens with a futures hedge, with the result that he purchases at $5.55/BU with the option instead of $6.40/BU with the futures, a non-trivial difference.

Basis Strengthening and Weakening

The trade speaks of strengthening and weakening basis. The cash price minus the futures price is basis. As mentioned earlier, the cash price represents local supply and demand conditions at a destination location such at the Gulf ports. The futures price represents demand and supply conditions on the average through the country.

Of course, it is possible for local demand and supply conditions to become tighter than they became nationally. While both prices would rise, the local cash price rises by more than national prices. Such a condition evidences a ***strengthening basis***.

Generally a farmer benefits from a strengthening basis ***because the net selling price is rising when basis is strengthening.*** A buyer loses because the ***net buying price is rising with a strengthening basis.***

The key to determining whether basis is strengthening or weakening is to determine what is happening to the ***net*** buying-selling price. That is, what is the net price after one considers the hedge leg? Here are some examples.

Farmer Hedging

A farmer always sells at the spot or cash price and hedges at the futures price. If the spot price rises by the same amount as the hedge leg short is losing, the farmer is hedged and has gained no advantage since neither the basis nor the net selling price has changed. So the basis is unchanged.

With rising prices, if the basis is strengthening, the cash selling price is rising by more than the short futures hedge loss, and the selling ***farmer wins with a strengthened basis because the net selling price rose.***

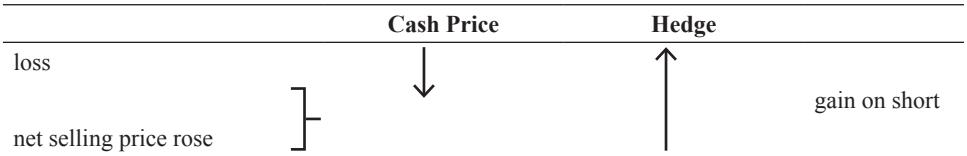
Strengthening Basis for Seller, Rising Prices

	Cash Price	Hedge	
Gain	↑	↓	Loss on short net selling price rose

In this case, local supplies became tighter than national supplies.

Commodity prices can fall as we get bumper crops. If the short hedge profit exceeds the cash leg loss, the farmer is still winning because ***the basis is strengthening because the net selling price rose.***

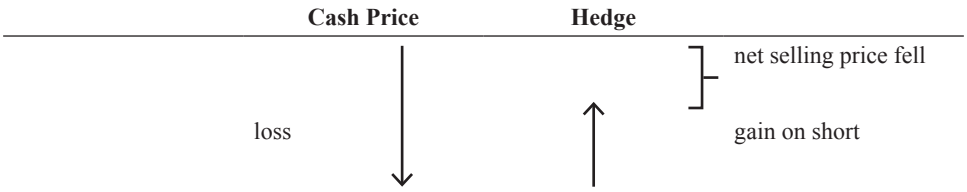
Strengthening Basis for Seller, Falling Prices



In this case, national prices (futures) fell by more than local prices (cash), causing the short hedge leg to win big. National supplies became more abundant than local supplies.

On the other hand, for a farmer with falling prices, if the cash leg falls by more than the short hedge leg profit, the cash loss is dominating the hedge leg profit, and ***farmer is losing because the net selling price is falling and the basis is weakening .***

Weakening Basis for Seller, Falling Prices



Here national prices fell less than local prices.

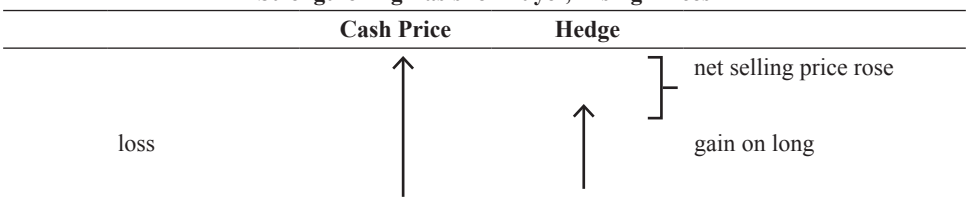
Buyer Hedging

What of the case of a commodity buyer? He is buying commodity for use in manufactured food. He buys at the cash price and hedges by going long in the futures market to protect against rising prices.

If the cash price rises by the same amount as the long hedge leg wins, the buyer is hedged, and the basis is unchanged, and his net purchase price is unchanged.

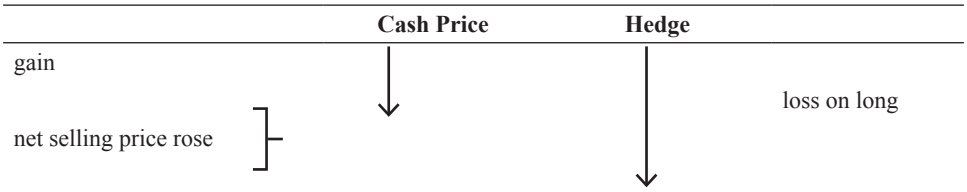
If the cash price rises by more than the futures leg win, the hedge leg does not offset the higher buying price, and ***the buyer loses because the basis strengthened since the net purchase price rose.***

Strengthening Basis for Buyer, Rising Prices



If prices are falling, it would seem that the buyer would win. But if the long hedge loss is greater than the cash leg gain, the buyer loses because ***the basis strengthened and the net purchase price rose***, even when prices are falling.

Strengthening Basis for Buyer, Falling Prices



Basis is strengthening because national prices are falling more than local prices, and we hedge with futures prices (national prices) and buy at local prices.

As mentioned earlier, the key to knowing whether basis is strengthening or weakening is to look at ***net prices after consideration of the hedge.*** If net prices are rising, the basis is strengthening, and buyers lose; if net prices are falling and basis is weakening, buyers win.

Moreover, with rising or falling prices, either a farmer or a buyer can win or lose.

Summary and Conclusions

This tutorial was developed as means to better understand commodity speculation since the commodity investment fund has now become a major outlet for speculative bets in the world's money markets. Since commodity price risk faced by agriculturalists are primarily laid off in the commodity futures markets, we study the ag futures contract. A major concept in futures theory is the basis between the futures price and the spot price. Since historical basis studies are used extensively by ranchers and framers, we focus upon the complexities of agricultural basis through hedging and trading examples involving grain hedging. The context used is a farmer anticipating selling his crop or a large commercial food processor that will buy institutional-sized quantities of commodity in the near future.

Since the proper hedging and trading on foodstuff derivatives requires a deep understanding of the complexities of basis, it is asserted that the study of grain hedging will give the student a better understanding of futures on more traditional spot markets in equities, bonds, and foreign exchange.

Basis studies, spreads, ag options, forward purchase agreements, selling or storing, basis strengthening or weakening, and futures margin put ups are some of the topics covered.

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Appendix

Homework

1. Short hedger with futures

Today is March. Based upon basis studies, say basis is expected to be 35 under the July futures contract when wheat is sold by the farmer in June, in week 23. July futures are priced at $6.50/BU. The farmer is worried that cash prices will fall by next June so he takes out a futures contract.

Say by week 23 the July futures now trades at $6.00/BU. That is, in June, national cash prices (as reflected by the futures contract) are expected by drop by

50 cents by July when the futures matures. We observe in June in week 23 that the expected basis held at 35 under. Meanwhile, our hedge made money in June.

Questions

a) In March, what does the farmer hope to sell the crop for by week 23 in the cash markets?
b) Why does he take out the July contract rather than the October contract?
c) Is his hedge long or short? Why.
d) What did the farmer finally sell the crop for in the spot markets before any consideration of the hedge?
e) If the basis held in week 23, describe what happened to supply-demand condition between the local market vs the national markets.
f) How much did the hedge make in dollars per BU.
g) Considering the hedge leg, what is the effective selling price for the farmer in week 23?
h) Is this price he had hoped for? Why did he get the price he had hoped for?
i) Explain why the futures market price dropped from March to week 23. How much did it drop?
j) Did the cash markets also drop? By how much. Why.

2. Long hedger with futures

Today is October. A buyer worries that soybean meal prices will rise by April, in week 15, when he will buy commodity. So he hedges with the May futures contract at $350/TON. Historical basis studies show that basis is expected to be 20 over May futures prices by week 15.

April comes and the buyer sees that the basis has strengthened to 40 over. He is glad he hedged. The May futures now trades at $400/TON.

Questions

a) What is the hedger's position? Long or short. Why.
b) Why does the hedger use a May contract.
c) Is the hedger a food manufacturer or a farmer?
d) In October, what does the hedger hope to buy for in week 15 in the cash markets?
e) Why was the original April basis 20 over instead of 20 under? Explain fully.
f) When April comes, what did the buyer actually buy the soybeans for per ton before any consideration of the hedge?
g) What was his profit or loss on the hedge per ton?
h) What market order did the buyer execute to clear out his hedge in April?
i) Explain fully why the basis moved. Explain what is happening.
j) After considering the hedge leg profit, what was the final net purchase price for the buyer?
k) Is this more or less than what the buyer had hoped to buy for? Why.
l) Why doesn't the buyer take deliver in the futures price? Explain fully.

m) Why do we use basis studies when we already have the quote for the futures price?
n) Assume for the moment that we are dealing with soybeans rather than soybean meal. If you looked at the basis studies chart for soybeans, and if the comparison year is 1997, what would the expected basis. Assume for the moment we are dealing with week 10.

3. Farmer spreading

Say a farmer has already set up a hedge with futures to protect his sale in June by shorting the July at $6.50/BU. Say that June comes and the July futures now trades for $6.00/BU. Basis on wheat for June is now 35 under.

However, in June, the farmer notices that the October futures trades at $6.60/BU. He considers holding and storing his crop and selling later at week 37 since $6.60/BU for October futures is 60 cents more than the price now in June of $6.00 for July futures. If he stored and sold in the following September, in week 37, say the basis from basis studies changed to 40 under. The cost of storing and financing wheat is $.0021/BU/day. Should he sell or store?

Questions

a) In June, what is the spread between the July and October futures? Be very specific.
b) In June, what could the farmer sell the crop for if he decided to sell rather than store? Show price before any hedge profit.
c) What was the hedge profit if he sold rather than store in June?
d) What is the final selling price including hedge profit if farmer sells in June rather than storing.
e) Now the farmer considers storing until September to take advantage of the rising prices. He would hedge short with an October futures. Considering the September basis is now 40 under the October futures, what would the farmer think in June that he could sell his crop for in September?
f) Before any consideration of cost of carry, what is the advantage so far for waiting until September to sell?
g) How much is the cost of carry for 90 days.
h) Should the farmer sell or store. Show numbers.

4. Evaluating a proposed purchase contract

Today in October a large cereal manufacturer that will source soybeans for its operations in February, in week 6, is offered a supply contract directly from a seller at $5.40/BU in week 6. The basis expected from basis studies is 24 over March futures for week 6. The March futures trades at $5.12/BU.

Questions

a) In October, what is the expected buying price if the buyer ignores the supply contract and buys in the spot markets in week 6?
b) Will the buyer have to hedge or not hedge in order to realize this spot market price?
c) Should the buyer accept or reject the supply contract offered to him in October. Why or why not.
d) If the buyer accepts the supply contract, will he have to hedge? Why or why not.
e) What if the supply contract is quoted differently. What if the offer is 28 over the March futures? Will the buyer have to hedge the supply price offer? Why or why not?

5. Disagreement over basis study forecast

What if the buyer disagrees with the previous basis study forecast of 24 over? What if the buyer thinks that supply-demand conditions will be tighter, more like 34 over?

Questions

a) What then does buyer expect to pay in the spot markets by week 6 if he buys in the cash markets and not through the supply contract?
b) Will he take the supply contract offer now? Why.

6. Basis strengthening and weakening

Assume a farmer will sell corn in February. Today in September he forecasts that the basis will be 20 over the March futures of $2.30/BU by February. Say by February the basis strengthened to 30 over and the futures price moved to $2.32/BU.

Questions

a) In September, what was the expected selling price in September?
b) If the basis strengthens while at the same time prices rise, does the farmer win or lose, assuming that the farmer hedges. Explain exactly how it works.
c) Describe the supply-demand conditions in the local market versus the national markets to cause the basis to strengthen.
d) What did the farmer actually sell his crop for in the cash markets in February before any consideration of the hedge?
e) How much did his futures hedge make or lose.
f) After consideration of hedge and the fact that the basis strengthened to 30 over, what was the net price the farmer sold the crop for.
g) If the basis had stayed at 20 over, what was the net price the farmer sold the crop for in February after consideration of the hedge.

h) Did the fact that the basis strengthened give the farmer a greater or lesser price. Show prices at 20 over and 30 over, net of any hedging.

Answers to Homework Problems

Homework 1

a) In March, the farmer expects to sell his crop in June for $6.50 - $.35 = $6.15/BU.
b) Because July is closest to June when the farmer sells.
c) Farmer hedges short because he worries about a price drop.
d) In June, the July futures trades at $6.00 less $0.35 = $5.65/BU.
e) Supply-demand conditions became abundant equally in both markets, causing the local and national prices to drop equally, making the basis steady.
f) Sell $6.50; buy at $6.00 = $0.50/BU hedge profit.
g) $5.65 + $0.50 = $6.15/BU
h) Yes; this is the same as originally hoped for at $6.15/BU; the basis held.
i) Futures market dropped $0.50 from $6.50/BU to $6.00/BU. Supply nationally was larger by June.
j) Yes. Cash markets dropped from $6.15/BU to $5.65/BU.

Homework 2

a) Long because buyer is worried price will rise.
b) May is nearest to the purchase date of April, week 15.
c) Long hedger is probably a food manufacturer.
d) $350/TON + $20/TON = $370/TON.
e) Probably because the cash market destination had higher transport costs than the national average due to the fact that this destination is relatively a longer distance from the central growing areas than average.
f) In week 15, buyer paid $400/TON + $40/TON = $440/TON.
g) Long hedge. Sell $400/TON; buy $350/TON = $50/TON profit.
h) Short futures in April to offset original long hedge.
i) Basis moved from 20 over to 40 over. By April, local supply-demand conditions tightened more than the national average.
j) $440/TON - $50/TON = $390/TON.
k) This is a bit more than expected ($390 versus $370/TON) because basis strengthened, to the detriment of the buyer.
l) Buyer needs commodity in April, and May futures expire and deliver a month too late.
m) Based upon studies of previous harvests, basis studies tell what we can expect to buy at in the cash markets usually a month before the futures expires. Futures prices are used for reference, not for buying (but they do reflect market prices expected at futures maturity date).

n) From chart, cash soybeans are expected to be 29.80 over near contract.

Homework 3

a) In June, the July–October futures spread became $6.00/BU to $6.60/BU = $0.60/BU.
b) $6.00/BU - $ .35/BU = $5.65/BU.
c) Sell $6.50/BU; buy $6.00/BU. $0.50/BU short hedge profit.
d) $5.65/BU + $0.50/BU = $6.15/BU final price in June
e) $6.60/BU - $0.40/BU = $6.20/BU prospective selling price in September.
f) $6.20/BU - $6.15/BU = $0.05/BU
g) $.0021/BU/day X 90 days - $.189/BU/90 days
h) $6.20 less storage cost of $.189/BU = $6.01/BU < $6.15/BU selling in June, so farmer should sell in June and not store.

Homework 4

a) $5.12/BU + $0.24/BU = $5.36/BU.
b) He will long a futures contract in case futures rises in price by February.
c) Supply contract offer $5.40/BU. Expected cash market sale is $5.36/BU. So he would not buy through the supply contract. But he would then face basis risk.
d) No. This supply contract is definite offering price, so the basis risk is eliminated.
e) In this case, because of the wording of the offer, the buyer would have to hedge because the supply contract price is dependent upon the futures price in October, which could go up, whereas with the direct offering price the farmer does not need to hedge.

Homework 5

a) In October, the March futures trading at $5.12/BU + $0.34/BU = $5.46/BU.
b) Since $5.46/BU > $5.40/BU accept supply contract and not buy in spot markets.

Homework 6

a) $2.30/BU + $0.20/BU = $2.50/BU
b) When basis strengthens, farmers win. When prices rise and basis is strengthening, he is selling crop in the cash market at a price that is rising faster than the short hedge is losing. A farmer is a short hedger.
c) Supply-demand conditions are tightening locally more than they are tightening nationally, causing the basis to strengthen.
d) $2.32/Bu + $0.30/BU = $2.62/BU.
e) Futures moved from $2.30/BU to $2.32/BU so farmer lost $0.02/BU on the short hedge.
f) $2.62/BU - $0.02/BU = $2.60/BU
g) $2.32/BU + $0.20/BU = $2.52/BU - $0.02/BU = $2.50/BU
h) Greater at $2.60/BU instead of $2.50/BU. Selling farmer wins when basis strengthens.

A Constrained Optimization Approach to Forecasting a Company's Borrowing Requirements

William A. Ogden
University of Wisconsin – Eau Claire

Pedro Sottile
University of Wisconsin – Eau Claire

Srinivasan Sundaram
Ball State University

Most introductory and intermediate finance courses include the topic of financial forecasting. Coverage usually includes forecasting new asset investments for the coming period while estimating the funding that will be available from internal sources, such as forecasted additions to retained earnings and spontaneous increases in current liabilities. The difference between the asset investments and the internal funding is the external funding requirement or the financial forecast. Missing in this analysis is the influence of constraints on the company's borrowing that arise from loan covenants or management's policies. In this paper, we present an Excel-based approach for forecasting borrowing requirements in which the resulting constrained optimization algorithm structures a solution that meets the funding requirements while working within management objectives and creditor's restrictions.

Introduction

Financial forecasting involves estimating the amount of capital a company will require in an upcoming period and devising a plan for its provision. Funding sources for a financing plan can include long-term debt, short-term debt, internal sources (current period's earnings or increases in accruals and payables) or a combination of these. Finding the combination of funding sources that best meets the company's needs is a complex task.

Finance courses include the basic principles of financial forecasting and may include more advanced coverage conditional on the level of the course. Textbooks used in these courses, such as Ross, Westerfield and Jaffe (2013), Berk

and DeMarzo (2014), Brealey, Myers and Allen (2014), and Brigham and Daves (2014), and accompanying materials, such as Holden (2014), present to students financial planning models that create pro forma income statements and balance sheets. These models typically employ a percent-of-sales based forecast and then solve for the external funding requirement. The "balancing" or "plug" item is the external funding that sets the right side of the balance sheet equal to the left side, or the sources of funds (increases to the right side of the balance sheet) equal to the uses of funds (increases in the left side of the balance sheet). Even popular Excel-based and practitioner-friendly resources frequently used in the classroom, such as Day (2012) and Benninga (2014), follow the same prescriptions. However, this balancing approach does not consider limitations on the amount the company can borrow on a short- or long-term basis (such as a minimum current ratio). Such constraints on a company's borrowings can require that the company either reduces its dividend payments or issues new common stock, or perhaps both.

For a given company, especially a small business, loan covenants or management objectives can limit options for raising new capital. Loan covenants can include solvency restrictions, such as maintaining a minimum net working capital or current ratio. Management objectives can include maintaining a dividend policy, a minimum cash balance or an ending solvency position. These types of restrictions will impact how a company structures its solution to obtaining required funding.

Structuring corporate borrowings has received attention in the corporate strategic management area. Sandberg, Lewellen and Stanley (1987) provide a probabilistic approach of selecting the company's financial leverage that assures a sufficiently high financial charge coverage ratio. Among studies that point to Sandberg, Lewellen and Stanley (1987), O'Brien (2003) finds that companies benefit from "financial slack" or excess reserve borrowing capacity when their competitive strategy is innovation. Kochhar and Hitt (1998) compare companies that diversify through acquisitions with others that emphasize internal development, pointing out that those that diversify tend to borrow more heavily than those that tend to grow through internal development. Folta and Janney (2004) investigate private equity placements as a form of external funding, indicating that private placements do not provide a reliable source of continuous funding. These studies are among a group that point to the Sandberg, Lewellen, and Stanley (1987) model as a conscious approach to selecting a debt level.

In this paper, we utilize the Sandberg, Lewellen and Stanley (1987) framework in conjunction with other company-specific financial constraints to develop a constrained optimization approach to structuring a company's funding for the next fiscal year at the lowest cost while working within a prescribed set of restrictions. We present an example of a company that has prepared its pro forma financial

statements and is ready to structure a solution to meeting its financial requirements. In contrast to textbooks that include standardized spreadsheet templates to guide students through the preparation of the pro forma statements, we develop a spreadsheet-based debt planning model (beginning from a blank sheet).To this end, we begin with a financial forecast for the upcoming year for an example company. The forecast estimates the funding shortages the company expects in each of the next four quarters. After forecasting the company's expected cash shortages, we use a linear programming approach to structure borrowings in order to provide for the expected shortages. By working within a set of constraints on borrowing set forth by the company's bank and its own management's objectives, the spreadsheet-based algorithm solves for the minimum cost plan to meet the company's financing needs.

The Model

The model utilizes a company's financial statements to find the minimum cost solution to providing funding while meeting the forecasted shortages for the next planning period. The minimum cost solution must:

- Provide sufficient funding to meet the expected shortages;
- Not exceed the maximum amount available from each funding source;
- Be consistent with management objectives toward managing debt, such as maintaining a minimum interest coverage ratio;
- Meet all requirements set by agreements with creditors, such as terms specified by loan covenants and line of credit agreements.

To structure the model, we begin with an example company's financial forecast for the upcoming period. The EHO Company is an internet service provider. We construct EHO's forecasted income statements, balance sheets and statements of cash flows for the next 4 quarters on one worksheet (with the name "Stmts"). For display clarity, we divide the worksheet into three sections, found in Figures 1, 2 and 3. To generate forecasts, we utilize a combination of the percent-of-sales method and individual balance sheet item forecasts. Note that no particular method of forecasting is necessary for the debt forecasting algorithm to work properly. We have included the forecasting model for EHO in Appendix A.

Figure 1. Forecasted Income Statements (X 1,000's) from Worksheet "Stmts"

	A	B	C	D	E
1	INCOME STATEMENTS	Q1	Q2	Q3	Q4
2	Sales	15,000	14,280	14,654	15,233
3	Cost of Goods Sold	12,000	11,424	11,723	12,186
4	Gross Margin	3,000	2,856	2,931	3,047
5	Operating Expenses	1,145	720	887	1,027
6	Depreciation	235	232	255	258
7	EBIT	1,620	1,904	1,789	1,762
8	Interest Expense	128	128	128	128
9	Earnings Before Taxes	1,492	1,776	1,661	1,634
10	Taxes	582	693	648	637
11	Earnings After Taxes	910	1,083	1,013	997
12	Common Dividends	110	110	110	110
13	To Retained Earnings	800	973	903	887
14					

To generate forecasts, a combination of the percent-of-sales method and individual balance sheet item forecasts is used. Interest expense is the sum of quarterly interest payments on a 15-year, 12% loan with amortization of 1/15 of the principal in the fourth quarter of each year, and the quarterly interest payments on short-term debt at 8%.

As shown in Figure 2, column B, EHO begins the forecasting period carrying permanent capital consisting of Long-Term Debt and Current Maturing Long-Term Debt ($3,758,000 + $493,000 = $4,251,000) and $7,174,000 of Equity. Without adding new capital during the forecasting period, the quarterly balance sheets and statements of cash flow will result as shown in Figures 2 and 3, respectively. EHO's target cash balance is 8% of sales.

Figure 2. Current Year and Forecasted Quarterly Balance Sheets (X 1,000) from Worksheet "Stmts".

	A	B	C	D	E	F
16	BALANCE SHEETS		Forecasted Values			
17		Current	Q1	Q2	Q3	Q4
18	Cash	1,284	-3,103	-2,509	-1,948	-1,464
19	Accounts Receivable	3,932	8,167	7,775	7,978	8,294
20	Inventories	4,379	5,000	4,760	4,885	5,078
21	Other Current	285	600	571	586	609
22	Total Current Assets	9,880	10,664	10,597	11,501	12,517
23	Gross Fixed	9,368	9,368	9,368	10,209	10,209
24	Less: Acc. Depreciation	5,280	5,515	5,747	6,002	6,260
25	Net Fixed	4,088	3,853	3,621	4,207	3,949
26	Other Assets	940	1,950	1,856	1,905	1,980
27	Total Assets	14,908	16,467	16,074	17,613	18,446
28						
29						
30	Accounts Payable	2,268	2,764	1,857	2,285	2,573
31	Accruals	1,215	1,478	1,019	1,226	1,378
32	Current Maturing LTD	493	493	493	493	493
33	Short-term loan	0	0	0	0	0
34	Total Current Liabilities	3,976	4,735	3,369	4,004	4,444
35	Long-Term Debt	3,758	3,758	3,758	3,758	3,265
36	Common Stock	280	280	280	280	280
37	Retained Earnings	6,894	7,694	8,667	9,571	10,457
38	Total Equity	7,174	7,974	8,947	9,851	10,737
39	Total Liabilities & Equity	14,908	16,467	16,074	17,613	18,446

EHO begins the forecasting period carrying permanent capital consisting of Long-Term Debt and Current Maturing Long-Term Debt ($3,758,000 + $493,000 = $4,251,000) and $7,174,000 of Equity (column B). Without adding new capital during the forecasting period, the quarterly balance sheets will result as shown. EHO's target cash balance is 8% of sales. For quarters 1 through 4, EHO is forecasting cash deficits (the forecasted values are from Figure 3, row 66).

For quarters 1 through 4, EHO is forecasting the following cash deficits (the forecasted values are from Figure 3, row 66):

	Quarter 1	**Quarter 2**	**Quarter 3**	**Quarter 4**
Forecasted Cash	-3,103	-2,509	-1,948	-1,464
Desired (8% of Revenues)	1,200	1,142	1,172	1,219
Deficit	-4,303	-3,651	-3,121	-2,682

The above deficits are estimates of the funding EHO must provide for the next four quarters. EHO has the following short and long-term funding sources available:

Source	Financing Rate	Maximum Principal
Line of Credit	8%	$750,000
Long-Term Debt	12%	Limited by times-interest-earned ratio

Figure 3. Forecasted Statement of Cash Flows (X 1,000) from "Stmts" worksheet.

	A	B	C	D	E
41	STATEMENT OF CASH FLOWS	Q1	Q2	Q3	Q4
42	Operating Activities				
43	Net Income	910	1,083	1,013	997
44	Depreciation	235	232	255	258
45	Accounts Receivable	-4,235	392	-203	-316
46	Inventory	-621	240	-125	-193
47	Other Current	-315	29	-15	-23
48	Accounts Payable	496	-907	428	288
49	Accruals	263	-459	207	152
50	Cash Flow from Operations	-3,267	610	1,560	1,163
51					
52	Investing Activities				
53	Fixed Assets	0	0	-841	0
54	Other Long-term Assets	-1,010	94	-49	-75
55	Cash Flow from Investing Activities	-1,010	94	-890	-75
56					
57	Financing Activities				
58	Short-term Debt	0	0	0	0
59	Current Maturity LTD	0	0	0	0
60	Long-term Debt	0	0	0	-493
61	Dividend	-110	-110	-110	-110
62	Cash Flow from Financing Activities	-110	-110	-110	-603
63					
64	Total Cash Flows	-4,387	594	560	485
65	Beginning Cash	1,284	-3,103	-2,509	-1,948
66	Ending Cash	-3,103	-2,509	-1,948	-1,464

Without adding new capital during the forecasting period, the quarterly statements of cash flow will result as shown. EHO's target cash balance is 8% of sales. For quarters 1 through 4, EHO is forecasting cash deficits as shown in row 66.

Long-term debt is in the form of a 15-year, 12% loan. EHO makes quarterly interest payments and repays 1/15 of the principal in the fourth quarter of each year.

The financial manager will utilize a combination of the company's short- and long-term funding sources in order to meet the company's forecasted deficits. However, the likelihood of being unable to cover fixed financial charges increases with higher levels of debt. The financial manager can structure short and long-term borrowings such that the probability of being unable to service the debt is acceptably low. Debt is serviced from operating profits that are generated by the company's assets. A measure that relates operating profits to a company's assets is the return on assets (ROA). The financial manager can calculate the probability of not having sufficient funds to meet fixed charges based upon the company's ROA forecast.

Limiting borrowing to a level that is consistent with the company's ability to service debt provides a company with a basis for managing its debt. In order for EHO to service its debt, the company's earnings before interest and taxes (EBIT) must equal or exceed its interest expense. Thus, the times-interest earned (TIE) ratio, defined as TIE = EBIT/Interest, must be equal to or greater than 1.0. The relationship between the TIE ratio and the ROA limits the amount EHO can borrow. The model that we develop below follows the approach suggested by Sandberg, Lewellen, and Stanley (1987), which develops the linkage between the TIE, ROA, and the probability of default on debt.

Sandberg, Lewellen, and Stanley (1987) define the coverage ratio (CR) as:

$$CR = EBTFC / FC, \quad [1]$$

where EBTFC is earnings before taxes and fixed charges. A higher coverage ratio is associated with a lower probability of default. Fixed charges include interest and other required before-tax payments such as leases. For our example company, interest is its only fixed charge. Accordingly, the fixed coverage ratio is equal to the times-interest-ratio (TIE), which is measured as:

$$TIE = EBIT / Interest, \quad [2]$$

where EBIT is earnings before interest and taxes. Expanding the TIE ratio reveals its components parts:

$$TIE = \left[EBIT / Assets\right] \times \left[Assets / Debt\right] \times \left[Debt / Interest\right]. \quad [3]$$

Rearranging, we have:

$$EBIT / Assets = TIE \times \left[Interest / Debt\right] \times \left[Debt / Assets\right]. \quad [4]$$

Return on assets (ROA) is commonly expressed on an after-tax basis (Net Income / Assets). In order to have after-tax income, a company must first generate

before-tax income. When associated with the TIE (a before-tax ratio) ratio, expressing ROA on a before-tax basis is more useful. Here, we define ROA on a before-tax basis as:

$$ROA = EBIT / Assets = TIE \times \left[Interest / Debt\right] \times \left[Debt / Assets\right]. \quad [5]$$

Hence, the components of ROA are the company's TIE, its interest rate on debt (R = Interest / Debt) and its leverage ratio (L = Debt / Assets). Thus, we can express ROA as:

$$ROA = TIE \times R \times L. \quad [6]$$

Solving [6] for TIE results in:

$$TIE = ROA / (R \times L) \quad [7]$$

For a company that maintains a target debt ratio of L^* and has a marginal interest rate on debt of R^*, the ratio of $1 / (R^* \times L^*)$ is a constant that we define as C. Equation [7] becomes:

$$TIE = ROA \times C. \quad [8]$$

With the interest rate and leverage ratio fixed, ROA and TIE are directly related. Statistically, the distributions of ROA and TIE are equal. Given the values for R^* and L^*, the company's ROA will cover its fixed charges (interest) exactly once if ROA equals the product of R* and L*:

$$TIE = 1.0 = ROA \times C = ROA / (R^* \times L^*), \text{ or } ROA = R^* \times L^* = ROA^*.$$

Thus, as an example, a company with a leverage ratio of 30% and an interest rate of 9% must earn an ROA^* of 30% x 9% = 2.7% in order to cover its interest charge once. Assuming that ROA is normally distributed and knowing the expected value (E_{ROA}) and the standard deviation ($STDEV_{ROA}$) of the company's ROA, we can test the probability that the coverage ratio will fall below l.00 with a Z statistic:

$$Z = [(R^* \times L^*) - E_{ROA}] / STDEV_{ROA}. \quad [9]$$

A company with an expected value and standard deviation of ROA of 15% and 4%, respectively, and with an interest rate of 9% and a 30% leverage ratio would have a Z-score of:

$$Z = (2.7\% - 15\%) / 4\% = -3.075.$$

The probability of a coverage ratio of 1.00 or less that corresponds to a Z-score value of -3.075 is 0.11%. This test can be utilized as a debt management tool to find the maximum leverage ratio a company can maintain in order to have a desired

probability of the coverage ratio (or TIE) falling below 1.0. Rearranging equation [9] to solve for ROA*:

$$ROA^* = E_{ROA} - Z \times STDEV_{ROA} \quad [10]$$

Based upon the previous 32 quarters, our example company EHO estimates that the expected value and standard deviation of its ROA are 10.3% and 3.0%, respectively. EHO's policy is that the probability of the CR falling below 1.0 shall be 1% or less. We solve for the ROA that corresponds to a 1% probability that the CR is equal to or less than 1. A standard normal distribution table or the Excel function "NORMSINV(Probability)" provides the critical Z-score:

= NORMSINV (1%) = - 2.326

Utilizing equation [10], we find EHO's ROA* value:

$ROA^* = 10.30\% - 2.326\ (3.0\%) = 3.32\%.$

With an expected ROA of 10.3% and a standard deviation of 3%, the probability of ROA falling below 3.32% and the CR falling to 1.0 or less equals 1%. With an expected ROA of 10.3%, EBIT will cover interest 10.3% / 3.32% = 3.10 times. An expected CR (or TIE) of 3.10 corresponds to a 1% probability that EBIT will not cover interest obligations.

Altogether, EHO manages its debt by working within the following constraints set forth by its management and creditors:

- Current ratio must equal or exceed 2.0 in all quarters, a requirement from a loan covenant;
- The maximum amount available from the line of credit is $750,000. The line of credit must have a zero balance for at least one quarter. The bank does not want the credit line to become permanent capital;
- The cash balance shall equal or exceed 8% of sales;
- The TIE ratio must equal or exceed 3.10, resulting in the probability of not having sufficient EBIT to meet interest expenses of 1% or less;
- EHO will pay a quarterly dividend of $110,000.

Our approach to structuring a solution to EHO's financing requirements limits long-term debt borrowing to quarter 1 only. We could permit long-term borrowings in all 4 quarters but it would unnecessarily complicate our example. We also assume that the lender does not permit early repayment of long-term debt.

To find the minimum cost solution to meeting the above constraints, we construct a linear programming solution for forecasting EHO's borrowings. We set up the worksheet "LP" (linear programming) as shown in Figure 4, and define the following variables:

Variable	Definition
XLOC(N)	A binary variable with a value of 1 if EHO borrows from the line of credit in quarter (N); otherwise is 0.
LOC(N)	The dollar amount EHO borrows from its line of credit in quarter (N).
LTD	The dollar amount EHO borrows as long-term debt in quarter 1.

Figure 4. Cost Function section of worksheet "LP".

	A	B	C	D
1		SOLUTION		FINANCING
2	Variable	VALUE	Rate	COSTS
3	XLOC1	0	0	0.000
4	XLOC2	0	0	0.000
5	XLOC3	0	0	0.000
6	XLOC4	0	0	0.000
7	LOC1	0	2.00%	0.000
8	LOC2	0	2.00%	0.000
9	LOC3	0	2.00%	0.000
10	LOC4	0	2.00%	0.000
11	LTD	0	12.00%	0.000
12			Total cost	0.000

To find the minimum cost solution to meeting the above constraints, we construct a linear programming solution for forecasting EHO's borrowings. Thus, we set up the worksheet "LP" (linear programming) as shown, and define the following variables from Column A: 1) XLOC(N) = a binary variable with a value of 1 if EHO borrows from the line of credit in quarter (N), otherwise is 0; 2) LOC(N) = the dollar amount EHO borrows from its line of credit in quarter (N); and 3) LTD1= the dollar amount EHO borrows as long-term debt in quarter 1. Then, decision variables are shown in Column B, "Solution Value". As an example, cell B11 is the amount of long-term debt EHO will borrow in quarter 1. Column C, "Rate", contains the periodic rates that the funding sources will cost EHO. The rate for XLOC1 is 0.0% since this is a binary variable that indicates only that the solution includes borrowings from the line of credit in quarter 1 but does not indicate the amount. The LOC1 value in column B is the actual amount that EHO would borrow from the line of credit in quarter 1. For line of credit borrowings, we enter the periodic rates in column C. Column D, "Financing Costs", is the cost function and is the product of Columns B and C, indicating the cost of borrowing from the line of credit. Cell D12 is the sum of cells D3 through D11 and represents the total financing cost solution.

Each XLOC (XLOC1 through XLOC 4) binary variable takes on a value of 1 if EHO borrows from the line of credit in a given quarter, otherwise 0. As an

example, if EHO borrows from the line of credit in quarter 1, XLOC1 takes on a value of 1. Limiting the sum of the XLOC binary variables to equal 3 or less prevents the solution from borrowing from the line of credit in more than three quarters. This meets the bank's requirement that the line of credit balance be zero for (at least) one quarter.

Decision variables are shown in Column B of Figure 4, "Solution Value." As an example, cell B11 is the amount of long-term debt EHO will borrow in quarter 1. Column C, "Rate," contains the periodic rates that the funding sources will cost EHO. The rate for XLOC1 is 0.0% since this is a binary variable that indicates only that the solution includes borrowings from the line of credit in quarter 1 but does not indicate the amount. The LOC1 value in column B is the actual amount that EHO would borrow from the line of credit in quarter 1. For line of credit borrowings, we enter the periodic rates (the nominal rates divided by 4) in column C. As an example, cell C7 sets the cost of borrowing from the company's line of credit at 8%/4 = 2% in quarter 1. Column D, "Financing Costs," is the cost function and is the product of Columns B and C. As an example, cell D7 is the product of cells B7 and C7, indicating the cost of borrowing from the line of credit in quarter 1. Cell D12 is the sum of cells D3 through D11 and represents the total financing cost solution.

We employ Excel's "Solver" function to achieve the objective of minimizing the total financing cost (cell D12 of Figure 4) while providing the necessary funds. In order to find the minimum, we write constraints that are consistent with the company's guidelines from above. We specify the constraints Solver must meet as follows:

No.	Purpose	Constraint
1	Borrowing from LOC1, XLOC1 = 1	750*XLOC1-LOC1 =>0
2	Borrowing from LOC2, XLOC2 = 1	750*XLOC2-LOC2 =>0
3	Borrowing from LOC3, XLOC3 = 1	750*XLOC3-LOC3 =>0
4	Borrowing from LOC4 XLOC4 = 1	750*XLOC4-LOC4 =>0
5	Minimum TIE	EBIT – 3.1*Interest =>0.0
6	Current ratio Q1 => 2.0	CA1-2.0*CL1 => 0.0
7	Current ratio, Q2 => 2.0	CA2-2.0*CL2 => 0.0
8	Current ratio, Q3 => 2.0	CA3-2.0*CL3 => 0.0
9	Current ratio, Q4 => 2.0	CA4-2.0*CL4 => 0.0
10	cash balance in Q1 exceeds 1,200	Cash Q1=>1,200
11	cash balance in Q2 exceeds 1,142	Cash Q2=>1,142
12	cash balance in Q3 exceeds 1,172	Cash Q3=>1,172
13	cash balance in Q4 exceeds 1,219	Cash Q4=>1,219
14	One quarter without LOC	XLOC1+XLOC2+XLOC3+XLOC4<=3

Constraints 1 through 4 have two purposes. First, they limit the amount that the company can borrow from the line of credit, up to a maximum of $750,000. The coefficient of the left side of the constraint sets the maximum amount that an acceptable solution can include from the line of credit. If the coefficient were 500, then the maximum borrowing from the line of credit in a quarter would be $500,000. Second, these constraints force each of the XLOC variables to take on a value of 1.0 if the solution includes borrowing from the line of credit. As an example, if LOC1 (the amount EHO borrows from the line of credit in quarter 1) has a value of $100,000, Constraint 1 would be:

$750,000 * XLOC1-100,000 => 0.

If XLOC1 (a binary variable) takes on a value of 0, the left side of the constraint will have a value of:

$750,000 * 0 -100,000 = -100,000.

Only if XLOC1 equals 1 can the left side of the constraint be equal to or greater than 0 if Solver borrows from the current line of credit in quarter 1. These constraints work in conjunction with constraint 14, which prevents Solver from borrowing from the current line of credit in more than 3 quarters per year. This constraint allows only 3 of the 4 XLOC binary variables to take on a value of 1. Constraint 5 is a transformation of the TIE (or coverage) ratio. The minimum TIE must equal or exceed 3.1. Hence, EBIT/Interest => 3.1, or EBIT - 3.1 * Interest => 0. In general, we transform constraints such that the variables are on the left side of the equation, constants are on the right, and all constraints are linear equations. We could create a separate section of the worksheet that displays all cost function and constraint constants and reference rather than hard code them. For ease of the exposition, we leave all these values as hard coded constants.

Linear equations permit us to utilize a linear rather than non-linear search algorithm. Constraints 6 through 9 are current ratio transformations resulting in linear equations that force the current ratio (current assets/current liabilities) to equal or exceed 2.0.

Constraints 10 through 13 force the algorithm to borrow sufficient funds in order to maintain a minimum cash balance in each quarter.

Figure 5 is a continuation of the "LP" worksheet in Figure 4. Rows 15 through 31 are the Excel formulations for constraints 1 through 14 above, respectively. We divide each constraint into left and right sides. We select relational operators ("<=", "=>", "=" and "bin") between the left and right sides through Excel's Solver dialogue box. All cells with references to 'Stmts' are linking to the 'Stmts' worksheet, which contains the balance sheets, income statements, and statements of cash flows.

Figure 5. Constraint Section of Worksheet "LP".

	A	B	C
14	Constraint	Left Side	Right Side
15	750*XLOC1 - LOC1 => 0	=C32*B3-B7	0
16	750*XLOC2 - LOC2 => 0	=C33*B4-B8	0
17	750*XLOC3 - LOC3 => 0	=C34*B5-B9	0
18	750*XLOC4 - LOC4 => 0	=C35*B6-B10	0
19	EBIT1-INT1*3.1 => 0	=Stmts!B7-3.1*Stmts!B8	0
20	EBIT2-INT2*3.1 => 0	=Stmts!C7-3.1*Stmts!C8	0
21	EBIT3-INT3*3.1 => 0	=Stmts!D7-3.1*Stmts!D8	0
22	EBIT3-INT3*3.1 => 0	=Stmts!E7-3.1*Stmts!E8	0
23	Current ratio, Q1	=Stmts!C22-2.0*Stmts!C34	0
24	Current ratio, Q2	=Stmts!D22-2.0*Stmts!D34	0
25	Current ratio, Q3	=Stmts!E22-2.0*Stmts!E34	0
26	Current ratio, Q4	=Stmts!F22-2.0*Stmts!F34	0
27	Cash balance Q1	=Stmts!B66	1,200
28	Cash balance Q2	=Stmts!C66	1,142
29	Cash balance Q3	=Stmts!D66	1,172
30	Cash balance Q4	=Stmts!E66	1,219
31	One quarter without LOC	=SUM(B3:B6)	3

Constraints 1 through 4 (rows 15 to 18) limit the amount that the company can borrow from the line of credit, up to a maximum of $750,000, and force each of the XLOC variables to take on a value of 1.0 if the solution includes borrowing from the line of credit. The coefficient of the left side of the constraint sets the maximum amount that an acceptable solution can include from the line of credit. These constraints work in conjunction with constraint 14 (row 31), which prevents Solver (Figure 6) from borrowing from the current line of credit in more than 3 quarters per year. This constraint allows only 3 of the 4 XLOC binary variables to take on a value of 1. Constraint 5 (rows 19 to 22) is a transformation of the TIE (or coverage) ratio. Constraints 6 through 9 (rows 23 to 26) are current ratio transformations resulting in linear equations that force the current ratio (current assets/current liabilities) to equal or exceed 2.0. Constraints 10 through 13 (rows 27 to 30) force the algorithm to borrow sufficient funds in order to maintain a minimum cash balance in each quarter. Figure 5 is a continuation of the "LP" worksheet in Figure 4.

Figure 6 is an image of the Excel Solver dialogue box (accessed from the "Tools" menu).We direct Solver to minimize cell D12 (Figure 4) of the "LP" worksheet by changing cells B3 through B11. We are asking Solver to minimize the cost function by choosing values for line of credit and long-term debt borrowings that meet all the constraints. Clicking on the "Add" button opens the "Add Constraint" dialogue box. We add the "=>" constraints in rows 15 through 30. We continue to click the "Add" button until we have included all constraints. After adding the constraints, we choose the "Simplex LP" option for "Select a Solving Method." Clicking on

Figure 6. Solver Dialogue Box.

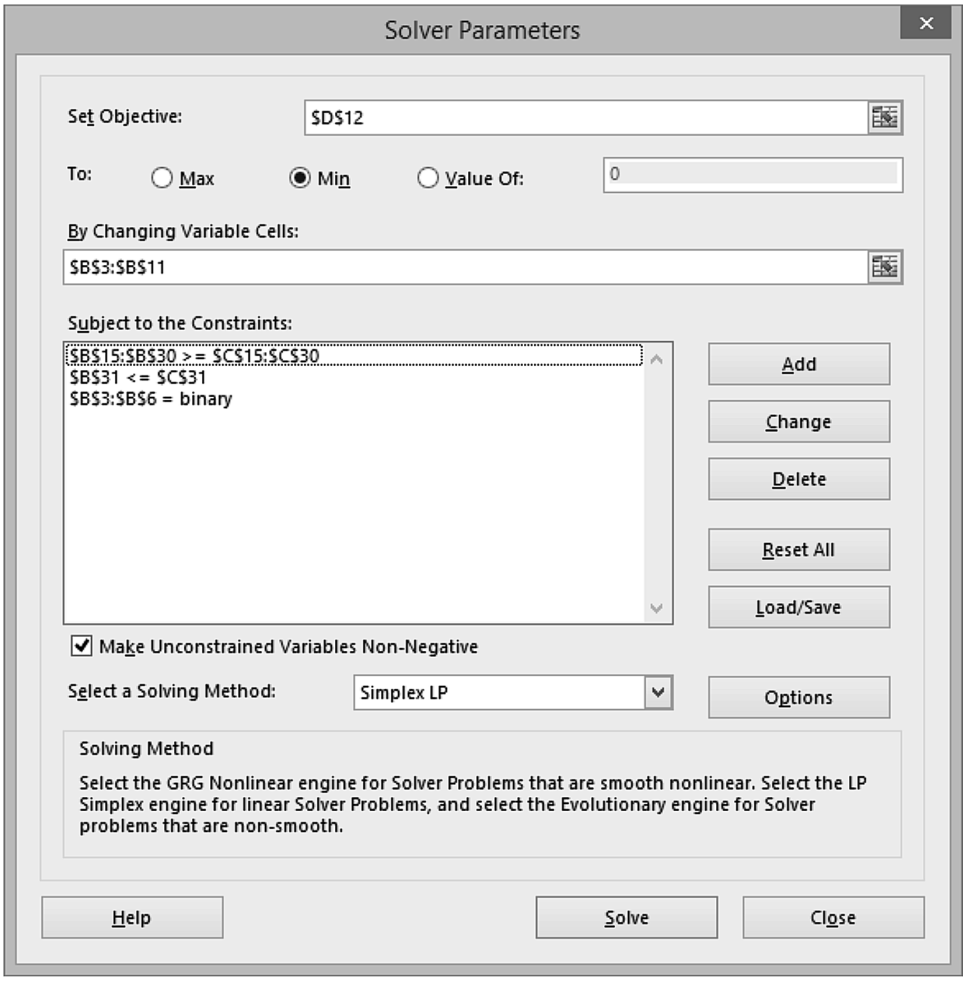

Figure 6 is an image of the Excel Solver dialogue box (accessed from the "Tools" menu).We direct Solver to minimize cell D12 (Figure 4) of the "LP" worksheet by changing cells B3 through B11. We are asking solver to minimize the cost function by choosing values for line of credit and long-term debt borrowings that meet all the constraints. Clicking on the "Add" button opens the "Add Constraint" dialogue box. We add the "=>" constraints in rows 15 through 30. We continue to click the "Add" button until we have included all constraints. After adding the constraints, we choose the "Simplex LP" option for "Select a Solving Method". Clicking on "Solve" generates the solution in Figure 7

"Solve" generates the solution in Figure 7. The resulting constraint values are in Figure 8, while the resulting income statements, balance sheets and statements of cash flows are in Figures 9, 10, and 11, respectively.

Figure 7. Solver Minimum Cost Solution (X 1,000) from the Solution in Figure 6.

	A	B	C	D
1		SOLUTION		FINANCING
2	VARIABLE	VALUE	RATE	COSTS
3	XLOC1	1	0	0
4	XLOC2	1	0	0
5	XLOC3	0	0	0
6	XLOC4	0	0	0
7	LOC1	750	0.02	15
8	LOC2	172	0.02	3
9	LOC3	0	0.02	0
10	LOC4	0	0.02	0
11	LTD	3,552	0.12	426
12			Total cost	445

The solution in Figure 7 was generated by the Solver function depicted in Figure 6. EHO's minimum cost funding solution states that the company should: a) borrow $750,000 (the full amount available) from the line of credit in quarter 1 and $172,000 in quarter 2. No borrowings from the line of credit in quarters 3 and 4; b) borrow $3,552,000 as a 15-year maturity long-term loan. The cost of this funding is $445,000.

EHO's minimum cost funding solution is as follows:

- Borrow $750,000 (the full amount available) from the line of credit in quarter 1 and $172,000 in quarter 2. No borrowings from the line of credit in quarters 3 and 4.

- Borrow $3,552,000 as a 15-year maturity long-term loan.

The cost of this funding is $445,000. In Figure 8, cells B15 through B18 have values greater than 0, indicating that borrowings from the line of credit were equal to or less than $750,000. The TIE ratio during each quarter exceeds 3.1 as indicated by constraints in cells B19 through B22 of Figure 8 having values greater than 0. The resulting current ratios for quarters 1 through 4 all exceed 2.0 as indicated by cells B23 through B26 having values greater than 0 (the actual current ratios values are 2.62, 3.77, 3.52, and 3.34, respectively). In quarters 1 and 2 the solution exactly meets the required minimum cash balance (cell B27 equals C27). For quarters 3 and 4 the ending cash balances exceeded their respective minimums. EHO borrows from the line of credit in quarters 1 and 2, meeting the lender's requirement that EHO draws from its line of credit in no more than 3 quarters of a given year (cell B31 takes on a value of 2).

Figure 8. Constraint values resulting from the Solution in Figure 7.

	A	B	C
	Constraint	Left Side	Right Side
15	750*XLOC1 - LOC1 => 0	0	0
16	750*XLOC2 - LOC2 => 0	578	0
17	750*XLOC3 - LOC3 => 0	0	0
18	750*XLOC4 - LOC4 => 0	0	0
19	EBIT1-INT1*3.1 => 0	1,225	0
20	EBIT1-INT1*3.1 => 0	1,132	0
21	EBIT1-INT1*3.1 => 0	1,052	0
22	EBIT1-INT1*3.1 => 0	1,036	0
23	Current ratio, Q1	3,523	0
24	Current ratio, Q2	6,693	0
25	Current ratio, Q3	6,431	0
26	Current ratio, Q4	6,266	0
27	Cash balance Q1	1,200	1,200
28	Cash balance Q2	1,142	1,142
29	Cash balance Q3	1,464	1,172
30	Cash balance Q4	1,647	1,219
31	One quarter without LOC	2	3

Cells B15 through B18 have values greater than 0, indicating that borrowings from the line of credit were equal to or less than $750,000. The TIE ratio during each quarter exceeds 3.1 as indicated by constraints in cells B19 through B22 having values greater than 0. The resulting current ratios for quarters 1 through 4 all exceed 2.0 as indicated by cells B23 through B26 having values greater than 0 (the actual current ratios values are 2.62, 3.77, 3.52, and 3.34, respectively). In quarters 1 and 2 the solution exactly meets the required minimum cash balance (cell B27 equals C27). For quarters 3 and 4 the ending cash balances exceeded their respective minimums. EHO borrows from the line of credit in quarters 1 and 2, meeting the lender's requirement that EHO draws from its line of credit in no more than 3 quarters of a given year (cell B31 takes on a value of 2).

On the Income Statement shown in Figure 9, Interest Expense calculation is based upon the beginning of the quarter debt value. For quarter 2, interest is the sum of the short- and long-term borrowings from Quarter 1 times their respective interest rates. The equation in cell C8 is "=12%/4*(C35+C32)+8%/4*C33", where C35, C32, and C33 are the quarter 1 values of Long-Term Debt, Current Maturity of Long-Term Debt and Short-Term Debt, respectively. Thus, the value for interest is 0.12/4*(7,073+730) + 0.08/4*750 = $249.

Figure 9. Income Statements with Proposed Funding (X 1,000).

	A	B	C	D	E
1	INCOME STATEMENTS	Q1	Q2	Q3	Q4
2	Sales	15,000	14,280	14,654	15,233
3	Cost of Goods Sold	12,000	11,424	11,723	12,186
4	Gross Margin	3,000	2,856	2,931	3,047
5	Operating Expenses	1,145	720	887	1,027
6	Depreciation	235	232	255	258
7	EBIT	1,620	1,904	1,789	1,762
8	Interest Expense	128	249	238	234
9	Earnings Before Taxes	1,492	1,655	1,551	1,528
10	Taxes	582	645	605	596
11	Earnings After Taxes	910	1,009	946	932
12	Common Dividends	110	110	110	110
13	To Retained Earnings	800	899	836	822
14					

Interest Expense calculation is based upon the beginning of the quarter debt value. For quarter 2, interest is the sum of the short- and long-term borrowings from Quarter 1 times their respective interest rates. The equation in cell C8 is "=12%/4*(C35+C32)+8%/4*C33", where C35, C32, and C33 are the quarter 1 values of Long-Term Debt, Current Maturity of Long-Term Debt and Short-Term Debt, respectively.

In Figure 10, Long-Term Debt in quarter 1 equals $7,073. The minimum cost solution calls for borrowing an additional $3,552 in long-term debt (cell B11 of Figure 7). The beginning values of Long-Term Debt and Current Maturing Long-Term Debt are $3,578 and $493, respectively. Recalling that the Long-Term Debt has a 15-year maturity, 1/15 of the new debt, or $3,552/15 = $237 is added to the current maturity for a total of $493 + $237 = $730. The remainder of the debt $3,552 - $237 = $3,315 is added to the beginning value of Long-Term Debt for a total of $3,758 + $3,315 = $7,073. The financial statement worksheets are linked to the "LP" worksheet to enable the solution values to be immediately implemented into the financial statements. As an example, the equation for Long-Term Debt in Cell C35 is, "=$B$35+LP!$B$11*14/15" and for Current Maturing LTD cell C32, the equation is, "=$B$32+(LP!$B$11)/15".

Figure 10. Balance Sheets with Proposed Funding (X 1,000).

	A	B	C	D	E	F
16	BALANCE SHEETS		Forecasted Values			
17		Current	Q1	Q2	Q3	Q4
18	Cash	1,284	1,200	1,142	1,464	1,647
19	Accounts Receivable	3,932	8,167	7,775	7,978	8,294
20	Inventories	4,379	5,000	4,760	4,885	5,078
21	Other Current	285	600	571	586	609
22	Total Current Assets	9,880	14,967	14,248	14,912	15,627
23	Gross Fixed	9,368	9,368	9,368	10,209	10,209
24	Less: Acc. Depreciation	5,280	5,515	5,747	6,002	6,260
25	Net Fixed	4,088	3,853	3,621	4,207	3,949
26	Other Assets	940	1,950	1,856	1,905	1,980
27	Total Assets	14,908	20,770	19,725	21,024	21,556
28						
29						
30	Accounts Payable	2,268	2,764	1,857	2,285	2,573
31	Accruals	1,215	1,478	1,019	1,226	1,378
32	Current Maturing LTD	493	730	730	730	730
33	Short-term loan	0	750	172	0	0
34	Total Current Liabilities	3,976	5,722	3,778	4,241	4,681
35	Long-Term Debt	3,758	7,073	7,073	7,073	6,344
36	Common Stock	280	280	280	280	280
37	Retained Earnings	6,894	7,694	8,594	9,430	10,252
38	Total Equity	7,174	7,974	8,874	9,710	10,532
39	Total Liabilities & Equity	14,908	20,770	19,725	21,024	21,556

Long-Term Debt in quarter 1 equals $7,073. The minimum cost solution calls for borrowing an additional $3,552 in long-term debt (cell B11 of Figure 7). The beginning values of Long-Term Debt and Current Maturing Long-Term Debt are $3,578 and $493, respectively. Recalling that the Long-Term Debt has a 15-year maturity, 1/15 of the new debt, or $3,552/15 = $237 is added to the current maturity for a total of $493 + $237 = $730. The remainder of the debt $3,552 - $237 = $3,315 is added to the beginning value of Long-Term Debt for a total of $3,758 + $3,315 = $7,073.

Figure 11. Statement of Cash Flows with Proposed Funding (X 1,000).

	A	B	C	D	E
41	STATETEMENT OF CASH FLOWS	Q1	Q2	Q3	Q4
42	Operating Activities				
43	Net Income	910	1,009	946	932
44	Depreciation	235	232	255	258
45	Accounts Receivable	-4,235	392	-203	-315
46	Inventory	-621	240	-125	-193
47	Other Current	-315	29	-15	-23
48	Accounts Payable	496	-907	428	288
49	Accruals	263	-459	207	152
50	Cash Flow from Operations	-3,266	536	1,493	1,098
51					
52	Investing Activities				
53	Fixed Assets	0	0	-841	0
54	Other Long-term Assets	-1,010	94	-49	-75
55	Cash Flow from Investing Activities	-1,010	94	-890	-75
56					
57	Financing Activities				
58	Short-term Debt	750	-578	-172	0
59	Current Maturity LTD	237	0	0	0
60	Long-term Debt	3,315	0	0	-730
61	Dividend	-110	-110	-110	-110
62	Cash Flow from Financing Activities	4,192	-688	-282	-840
63					
64	Total Cash Flows	-84	-58	321	184
65	Beginning Cash	1,284	1,200	1,142	1,464
66	Ending Cash	1,200	1,142	1,464	1,647

Our example company, EHO now has an idea of its borrowing requirements for next year. EHO set their quarterly dividend at $110,000 each quarter. If necessary, we could have structured the company's dividend as the clean surplus remaining after all capital investment and borrowings were accounted for.

Implementing the Model in the Classroom

The forecasting model has three components: financial forecasting, the probability of the coverage ratio falling below 1.0, and the constrained optimization.

In order to include this model in our curriculum, we cover all three components, culminating with a case study.

Initially, we cover financial forecasting in general. Sufficient coverage is available in most intermediate finance textbooks. Financial forecasting will take around two class periods. After a brief review of sources and uses of funds, we present forecasting methods, beginning with the percent of sales method, with which forecasted net fixed assets and net working capital values are assumed to vary directly with sales. Hence, a 10% increase in sales results in a 10% increases in both net working capital and net fixed assets. The financial forecast (or external funding requirement) is the difference between the "new" assets (forecasted minus current levels of net fixed assets and new working capital) and internal funding sources (forecasted net income added to retained earnings to help fund new investments). Next, we relax the percent of sales assumption and permit forecasting individual balance sheet values. As an example, a company might be collecting receivables well past the time that their terms of sale permit. If the terms of sale are net 30 but the company collects on average in 45 days, extra efforts toward speeding up collections could result in faster collections and an accounts receivable forecast value that is less than the percentage increase in sales. If balance sheet values are forecasted, the financial forecast (external funding requirement) will be the difference between the cumulative changes to the left side of the balance sheet less the cumulative changes to the right side (which includes internal funding). The constrained forecasting model that we presented above does not require that a specific forecasting model be employed but the forecast must include a pro forma income statement, balance sheet and statement of cash flows. Assurance of learning for the basics of financial forecasting is accomplished by assigning questions from the financial forecasting chapter of an intermediate finance text, such as Chapter 29 of Brealey, Myers and Allen (2014) or Chapter 3 of Ross, Westerfield, Jaffe (2013) and including questions on a midterm exam.

We devote approximately two class periods to the Sandberg-Lewellen-Stanley financial leverage model. Since this model is not included in intermediate level financial management texts, we write a set of questions that test the students' ability to calculate the probability of the coverage ratio falling below 1.0 for several scenarios, and also calculate the highest the company's leverage ratio can be for a given probability of the coverage ratio (TIE) falling to or below 1.0. We also include several questions related to the model on a midterm exam.

In the final part in our assurance of learning, we assign a case that is similar to the EHO Company example. Several weeks before the assignment is due, we dedicate two class periods to the EHO example. We provide the financial statements that we show in Figures 1 and 2 (students will generate the statement of cash flows). As an in-class exercise, we find the optimal solution for the EHO Company example. When compared to the EHO Company example, the case that we assign

will have a company that has a different set of financial statements and operational constraints. Students must submit their solutions to the case before the last day of classes. On the final exam, we also ask students to write a set of appropriate constraints that limit a company's borrowing options, such as writing a constraint that requires that the current ratio be greater than 2.0 for given levels of current assets, payables and accruals.

Concluding Remarks

Estimating the amount of capital a company will require to fund its expected investments during the next year is a two-step process: develop a financial forecast of asset requirements and allocate resources. We develop a spreadsheet-based model that allocates financial resources based on minimizing the total cost of the external financing. The model helps a company develop a borrowing plan for the next period. The model provides a framework for establishing a debt management strategy that is consistent with constraints that are unique to an individual company. The model is flexible in that a financial manager can include numerous constraints that structure the borrowing plan to minimize costs while working within the specific company's borrowing limitations and operational constraints (such as maintaining a minimum cash balance or current ratio). In addition, the model limits borrowing such that the company has an acceptable probability of having a sufficient EBIT to meet interest expenses.

Developing this model benefits students not only from the analysis of a more sophisticated financial problem, but also by having them apply spreadsheets to financial analysis, an essential piece in students' education that will unquestionably transcend into their business careers.

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Appendix A: Financial Forecasting Model assumptions for the EHO Company

Income Statement Forecasts	
Sales	7% greater than same quarter from the previous year.
Cost of materials	80% of sales.
Operating expenses	7% greater than same quarter from the previous year.
Depreciation	2.5% of Net Fixed Assets.
Balance Sheet Forecasts	
Cash	From Statement of Cash Flows.
Accounts Receivable	54.44% of sales.
Inventories	33.33% of sales.
Other Current	4.00% of sales.
Fixed Assets	Previous year's value + 841 in third quarter.
Depreciation	Previous quarter's value + depreciation from income statement.
Other Assets	13% of sales.
Accounts Payable	7% greater than same quarter from the previous year.
Accruals	7% greater than same quarter from the previous year.
Current Maturing LTD	Previous year's ending value.
Short-term loan (initially 0)	Initially 0.00 for all four quarters of forecast
Long-term debt	Previous year's ending value.
Common Stock	Previous year's ending value.
Retained Earnings	Previous quarter's value plus net income less dividend.

Sensitivity Analysis in Capital Investment Appraisal: An Excel/VBA Application

Terry Pope
Abilene Christian University

Jonathan Stewart
Abilene Christian University

Most students at the undergraduate level gain exposure to capital investment appraisal through a course in corporate finance. Many textbooks include Excel templates for performing the necessary analysis. However, student learning is usually not extended beyond what can be accomplished rather easily in Excel. This paper will offer an Excel template for capital investment appraisal with an extension to sensitivity analysis accomplished using VBA macros. The development of VBA macros to perform sensitivity analysis is generally not included in undergraduate textbooks. The macros presented here accomplish a specific task—creating a Tornado Chart—while illustrating VBA techniques that will enable students to gain a significant grasp of VBA and how it might be used in other applications.

Introduction

Most students at the undergraduate level gain exposure to capital investment appraisal through a course in corporate finance. Popular textbooks such as Brigham and Huston (2013) and Ross, Westerfield, and Jordan (2013) provide the theoretical framework for performing the analysis. The need for sensitivity analysis is discussed with some simple charts developed to provide the analyst a sense of the impact that deviations from the base case assumptions might have on investment return. In some cases, an Excel template is provided to assist with the analysis.

This paper presents a case involving investment appraisal, an Excel template useful in performing the analysis, and a quick look at the standard sensitivity analysis tools available in Excel. Then two VBA macros are presented that are useful in performing sensitivity analysis which goes beyond that provided by the basic tools. Specifically, these macros develop a Tornado Chart, a very useful way to view the impact that variations from base case assumptions might have on investment return.

Few undergraduate finance textbooks provide instruction on the use of VBA to equip students with the ability to go beyond the basic tools of Excel in their analysis. More advanced books, such as Benninga (2014), Jackson and Staunton (2001), and Sengupta (2010) provide some basic instruction in VBA. While the macros presented in this paper are used to develop a Tornado Chart, their usefulness in the classroom goes well beyond that specific purpose to illustrate several VBA techniques that are applicable in many situations.

The following sections of the paper are: the case entitled Alpine Tours which describes an investment opportunity to be evaluated; an Excel template providing the analysis for the case; sensitivity analysis using the standard tools of Excel; VBA macros for constructing a Tornado Chart; and the conclusion.

Case—Alpine Tours

Ben Sullivan and Chad Waters have been friends for several years, having met at a mountain biking event in New Mexico. Ben attended Sul Ross State University in Alpine, Texas majoring in History. Chad graduated from Abilene Christian University three years ago with a major in Financial Management. Both have stayed in touch and share an entrepreneurial bent. Over the past couple of years, they have been discussing the idea of starting a company that would operate bus tours between Alpine and Big Bend National Park, in far southwest Texas.

Alpine is a small town of 5,000 residents located about 75 miles north of the national park headquarters. Having attended the university there, Ben is thoroughly familiar with the area and with the businesses that currently cater to tourists. Since graduating two years ago, he has continued to live in Alpine and work as a mountain bike tour guide. Though Chad grew up in Fort Worth, he is interested in living in a smaller, more remote area of the state. Since his graduation from Abilene Christian University he has worked for a fund manager in Austin.

During the past year, the intensity of their pursuit of the bus tour idea has increased significantly. They have visited similar ventures across the south and southwest in order to glean information regarding the costs, benefits and associated challenges. They have investigated the permitting requirements and are satisfied these could be met. To date, about $10,000 has been spent moving up the learning curve regarding the feasibility of this venture. It seems that it is time to move forward with a financial analysis.

For risk management reasons, they would organize as a corporation and experience a marginal income tax rate of 35%. To pursue this venture, they are requiring a minimum rate of return of 12%, their expected cost of capital, to be realized from cash flows during the first six years. Through contacts that Chad has made in the fund management business, financing is available to enable their purchase of busses.

Following are the key parameters underlying the venture.

- They would acquire 5 fifty-passenger busses, at the cost of $300,000 each. After six years, each would have a salvage value of $20,000.
- Each bus would make 60 trips in the first year increasing by 5 trips per year to a maximum of 80. Each trip would incur $5,000 in operating expenses.
- Annual fixed operating expenses would total $200,000, covering facility rental, salaries, maintenance, etc.
- Trips would have an average occupancy of 35 people in the first year, growing by 5 each year until the bus capacity has been reached.
- Each passenger would pay $150 in the first year, increasing by 1% above inflation for each year thereafter.
- Inflation is expected to average 2% annually. All operating expenses are expected to increase with inflation.

Questions

1. Assuming that the above operational assumptions are reasonable, would you recommend that they pursue this venture? Explain.
2. Determine the financial breakeven values for the following:
   c. Cost per bus = $358,620
   d. Initial operating expense per trip = $5,221
   e. Initial price per passenger = $145.19
3. Construct a scatter plot on a separate sheet showing the IRR on the vertical axis and initial price per passenger on the horizontal axis. The initial price per passenger should range from $140 to $160 in increments of $5. Put titles on both axes and place a dashed line showing the breakeven value of the price per passenger.
4. Display a two-variable Data Table on a separate sheet showing the IRR. The horizontal component of the table should be initial trips per year per bus, ranging from 40 to 80 in increments of 10. The vertical component of the table should be the initial passengers per bus with the values 20, 30, 35, 40, and 50. Use conditional formatting to shade the IRRs in green that exceed the required rate of return and shade in white if negative. Place appropriate titles where needed. The IRR in the upper left corner used to construct the table should not be displayed.

5. Construct a Tornado Chart that shows the impact on IRR of variations of 10% above and below the base case for several operational assumptions.

Excel Template

Exhibit 1 provides a template for developing the net cash flow associated with this investment opportunity. All of the assumptions underlying the base case are shown in column A. The Net Present Value (NPV) and the Internal Rate of Return (IRR) are shown at the top of column A. When using Excel's NPV function, it is important to know that the time-zero cash flow should not be included with the values to be discounted. The focus of this template is to show the impact that each of the assumptions makes on after-tax net cash flow. When considering investment opportunities, we want students to think primarly about how the various operational assumptions affect after-tax net cash flow.

Having completed the base case analysis and having found the IRR to exceed the required return, students need to realize that the work has only just begun. High credibility for the analyst will hinge on the thoroughness of the sensitivity analysis that follows.

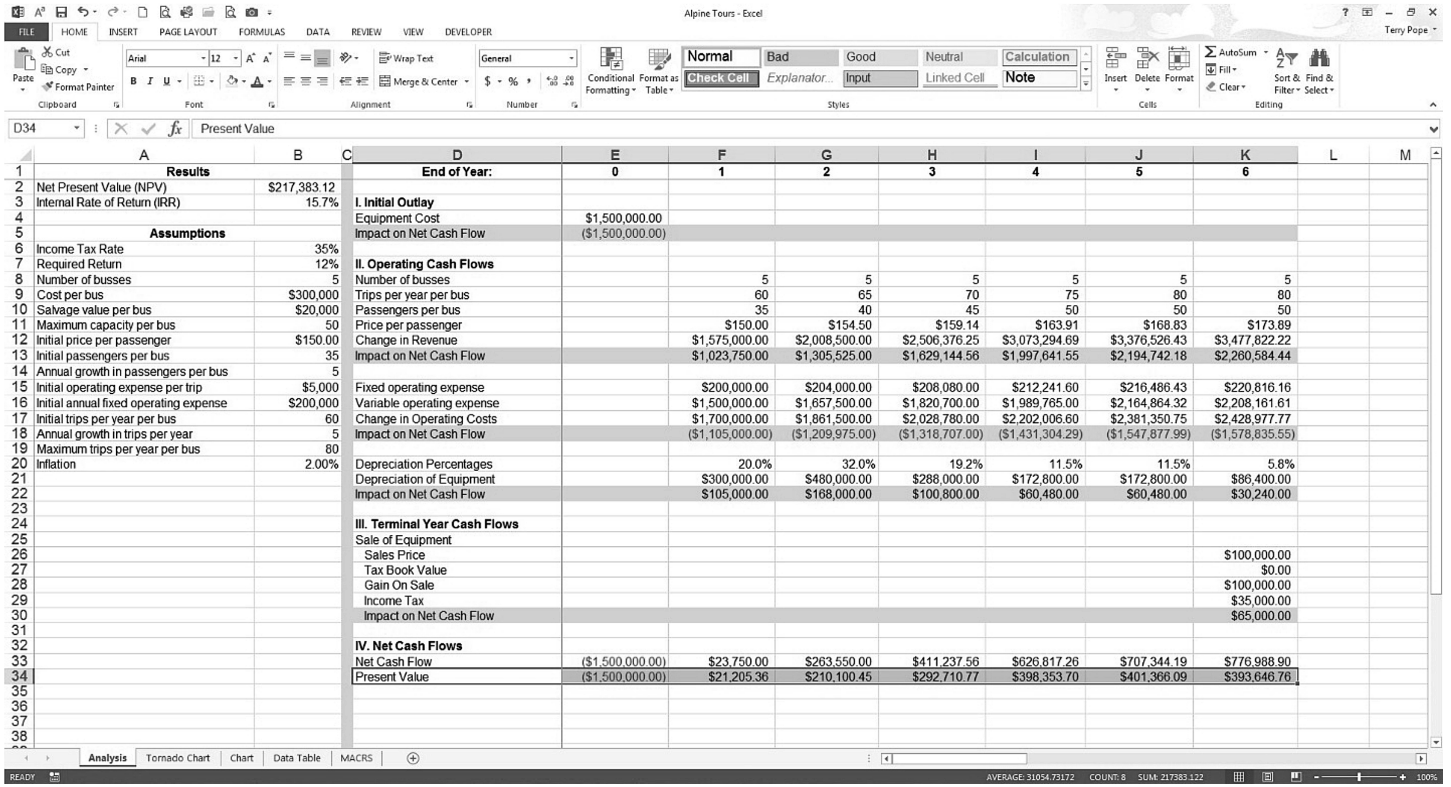
Sensitivity Analysis

Questions 2-4 at the end of the case are easily addressed using the standard sensitivity analysis tools found under the What If Analysis tab under the Data tab on Excel's Ribbon. The financial breakeven values sought in question 2 are determined by using the Goal Seek tool found under What If Analysis. The dialogue box that appears upon selecting Goal Seek, the status of the Goal Seek, and the breakeven value of $358,620 found in cell B9 are shown in Exhibit 2.

The data necessary to produce the scatter plot requested in Question 3 is most easily assembled using the Data Table tool found under the What If Analysis tab. The format for a one-variable Data Table is shown on the right in Exhibit 3. The values of the variable Price per Person requested for the plot are arranged in a column one row below and one column to the left of the cell to be recalculated, which is the IRR. Upon completion of the dialogue box shown on the left, the shaded cells in the Data Table are populated. Thus the five data points needed to produce the requested plot are available. The scatter plot, with a trendline, is shown at the bottom of Exhibit 3. The values shown on the axes may be modified by right-clicking on the axes and using the editing facility to select the desired minimums, maximums and interval spacing.

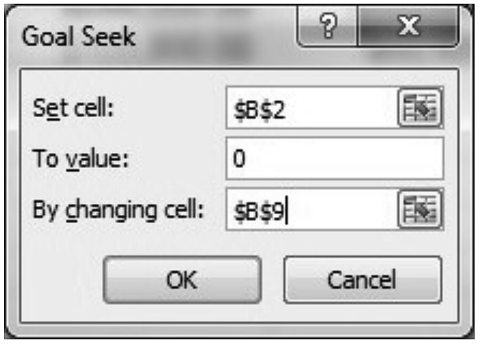
The format for the two-variable Data Table requested in Question 4 is shown in Exhibit 4. Upon completion of the dialogue box shown on the left, the shaded

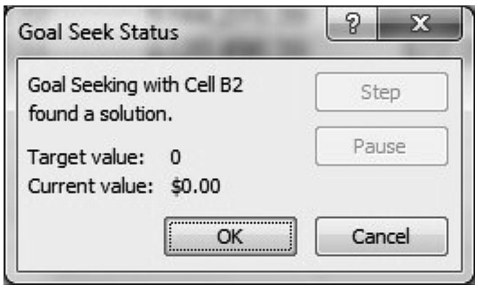
Exhibit 1



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Results**			**End of Year:**	**0**	**1**	**2**	**3**	**4**	**5**	**6**		
2	Net Present Value (NPV)	$217,383.12											
3	Internal Rate of Return (IRR)	15.7%		**I. Initial Outlay**									
4				Equipment Cost	$1,500,000.00								
5	**Assumptions**			Impact on Net Cash Flow	($1,500,000.00)								
6	Income Tax Rate	35%											
7	Required Return	12%		**II. Operating Cash Flows**									
8	Number of busses	5		Number of busses		5	5	5	5	5	5		
9	Cost per bus	$300,000		Trips per year per bus		60	65	70	75	80	80		
10	Salvage value per bus	$20,000		Passengers per bus		35	40	45	50	50	50		
11	Maximum capacity per bus	50		Price per passenger		$150.00	$154.50	$159.14	$163.91	$168.83	$173.89		
12	Initial price per passenger	$150.00		Change in Revenue		$1,575,000.00	$2,008,500.00	$2,506,376.25	$3,073,294.69	$3,376,526.43	$3,477,822.22		
13	Initial passengers per bus	35		Impact on Net Cash Flow		$1,023,750.00	$1,305,525.00	$1,629,144.56	$1,997,641.55	$2,194,742.18	$2,260,584.44		
14	Annual growth in passengers per bus	5											
15	Initial operating expense per trip	$5,000		Fixed operating expense		$200,000.00	$204,000.00	$208,080.00	$212,241.60	$216,486.43	$220,816.16		
16	Initial annual fixed operating expense	$200,000		Variable operating expense		$1,500,000.00	$1,657,500.00	$1,820,700.00	$1,989,765.00	$2,164,864.32	$2,208,161.61		
17	Initial trips per year per bus	60		Change in Operating Costs		$1,700,000.00	$1,861,500.00	$2,028,780.00	$2,202,006.60	$2,381,350.75	$2,428,977.77		
18	Annual growth in trips per year	5		Impact on Net Cash Flow		($1,105,000.00)	($1,209,975.00)	($1,318,707.00)	($1,431,304.29)	($1,547,877.99)	($1,578,835.55)		
19	Maximum trips per year per bus	80											
20	Inflation	2.00%		Depreciation Percentages		20.0%	32.0%	19.2%	11.5%	11.5%	5.8%		
21				Depreciation of Equipment		$300,000.00	$480,000.00	$288,000.00	$172,800.00	$172,800.00	$86,400.00		
22				Impact on Net Cash Flow		$105,000.00	$168,000.00	$100,800.00	$60,480.00	$60,480.00	$30,240.00		
23													
24				**III. Terminal Year Cash Flows**									
25				Sale of Equipment									
26				Sales Price							$100,000.00		
27				Tax Book Value							$0.00		
28				Gain On Sale							$100,000.00		
29				Income Tax							$35,000.00		
30				Impact on Net Cash Flow							$65,000.00		
31													
32				**IV. Net Cash Flows**									
33				Net Cash Flow	($1,500,000.00)	$23,750.00	$263,550.00	$411,237.56	$626,817.26	$707,344.19	$776,988.90		
34				Present Value	($1,500,000.00)	$21,205.36	$210,100.45	$292,710.77	$398,353.70	$401,366.09	$393,646.76		
35													
36													
37													
38													

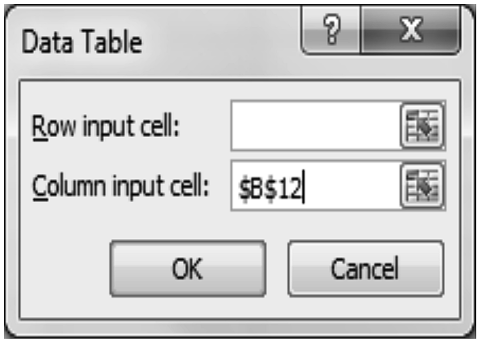
Exhibit 2—Goal Seek





Results	
Net Present Value (NPV)	$0.00
Internal Rate of Return (IRR)	12.0%
Assumptions	
Income Tax Rate	35%
Required Return	12%
Number of busses	5
Cost per bus	$358,620

Exhibit 3—Data Table and Chart



	15.7%
$140.00	7.8%
$145.00	11.9%
$150.00	15.7%
$155.00	19.3%
$160.00	22.8%

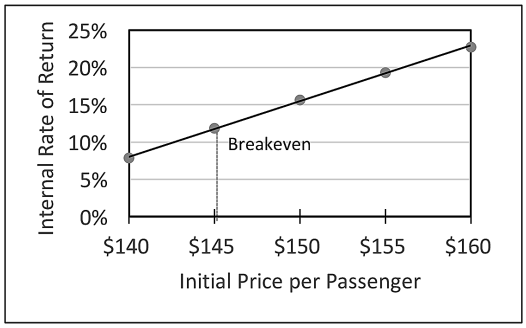
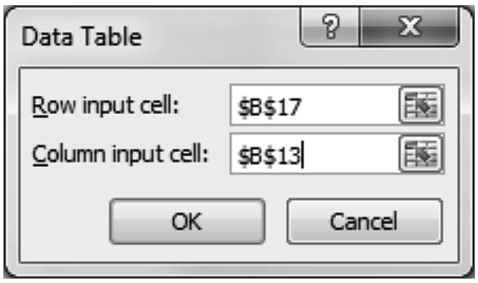


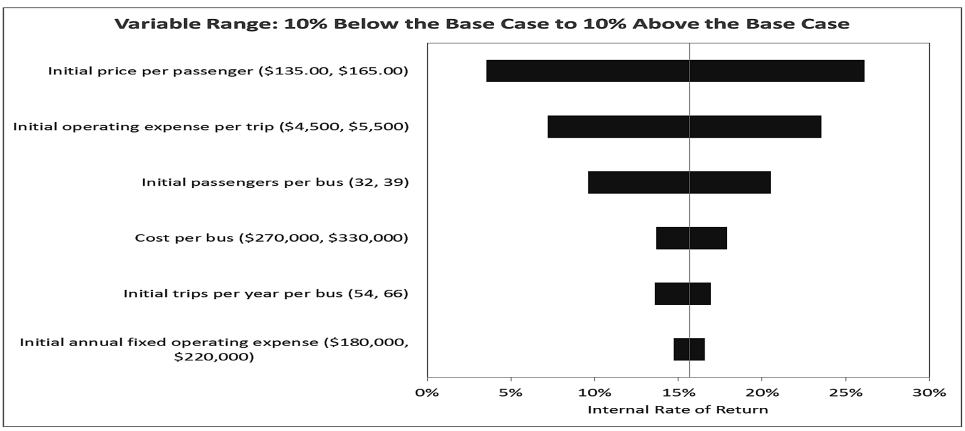
Exhibit 4—Two-variable Data Table



15.7%	40	50	60	70	80
20	-20.4%	-18.6%	-17.9%	-18.8%	-19.5%
30	0.9%	4.5%	7.1%	7.8%	7.7%
35	7.3%	11.9%	15.7%	17.5%	17.9%
40	12.3%	17.9%	22.7%	25.8%	26.9%
50	17.7%	24.8%	31.3%	36.2%	39.0%

Initial Passengers per Bus	Initial Trips per Year per Bus				
	40	50	60	70	80
20					
30	0.9%	4.5%	7.1%	7.8%	7.7%
35	7.3%	11.9%	15.7%	17.5%	17.9%
40	12.3%	17.9%	22.7%	25.8%	26.9%
50	17.7%	24.8%	31.3%	36.2%	39.0%

Exhibit 5—Tornado Chart



cells in the Data Table are populated. Then the question called for the Data Table to be "cleaned up" by using conditional formatting so that it would contribute to an attractive presentation. This clean version is shown at the bottom of Exhibit 4.

Question 5 requests a Tornado Chart. This chart, shown in Exhibit 5, is so named because the bars are sorted from long to short, providing the look of a funnel. It provides an excellent look at the affect on the IRR of variations in the values of selected operational assumptions. The vertical line in the center of the chart reflects the IRR using base case assumptions.

Assembling the data and constructing the chart using only Excel is rather laborious and beyond the skill set of most users (Eschenbach, 2006). Excel addins are available commercially (Middleton & Smith, 2014) to produce a chart similar to this. In situations like this, we encourage our students to develop Excel workbooks that are user friendly, in that they enable the user to produce charts like the Tornado Chart while not requiring the user to have advanced Excel skills. In developing user friendly workbooks, the use of VBA macros becomes very useful and often essential. While the macros discussed in the next section accomplish the specific tasks of preparing the data and constructing the Tornado Chart, they also equip students with a VBA skill set that enables them to develop other useful macros.

VBA Macros—Tornado Chart

The Excel template presented in Exhibit 1 will be developed further to enable the user to produce a Tornado Chart like shown in Exhibit 5 with the click of a button. The user would prepare a table as shown in Exhibit 6 anywhere to the right of the last column shown in Exhibit 1. The shaded cells in the first column identify the operational assumptions, from among those specified in column A of Exhibit 1, that the user wishes to include in the Tornado Chart. The shaded cells in the next two columns indicate the amount of variation in each assumption, as a percentage down/up from the base case. The button with the name Solve will have the macro named Tornado assigned to it. Upon filling the shaded cells, the user will click the button and the table will expand with data needed for the Tornado Chart and the chart will appear on a chart sheet entitled Tornado Chart.

Exhibit 7 shows the table of Exhibit 6 after the button has been clicked. The numbers under the shaded cells are the values of the operational parameters after they have been adjusted from the base case. The next two columns provide the IRRs associated with the low value and the high value of the operational parameters. The last three columns arrange this data in the form needed to produce the Tornado Chart. Under the heading Parameters, the names of the operational parameters are combined with the low and high values that these parameters will assume. Under the heading Min is the smallest of the IRRs shown in the Low and High columns. This number will be the left end of the bar in the chart. Under the heading Range is the difference between the IRRs for the low and high case. This number will be the length of the bar. The macro then sorts this table by the range in ascending order.

Both macros are shown in Exhibit 8. The line numbers are not part of the code and appear only to facilitate an explanation of the macros. Following is a brief description of various sections of the macros.

Lines 10-19: When the user has completed the table shown in Exhibit 6, they will select the cell in the upper left corner of the table. This Active Cell location (row number and column number) is used frequently

Exhibit 6

Solve	-10%	10%
Initial annual fixed operating expense		
Initial trips per year per bus		
Cost per bus		
Initial passengers per bus		
Initial operating expense per trip		
Initial price per passenger		

Exhibit 7

Solve	-10%	10%	Low	High	Parameters	Min	Range
Initial annual fixed operating expense	$180,000	$220,000	16.6%	14.7%	Initial annual fixed operating expense ($180,000, $220,000)	14.7%	1.9%
Initial trips per year per bus	54	66	13.6%	17.0%	Initial trips per year per bus (54, 66)	13.6%	3.3%
Cost per bus	$270,000	$330,000	17.9%	13.7%	Cost per bus ($270,000, $330,000)	13.7%	4.2%
Initial passengers per bus	32	39	9.6%	20.5%	Initial passengers per bus (32, 39)	9.6%	10.9%
Initial operating expense per trip	$4,500	$5,500	23.6%	7.2%	Initial operating expense per trip ($4,500, $5,500)	7.2%	16.4%
Initial price per passenger	$135.00	$165.00	3.5%	26.1%	Initial price per passenger ($135.00, $165.00)	3.5%	22.6%

in completing the table of Exhibit 7. The column headings for the table are completed.

Line 23: The number of operational parameters to be included in the Tornado Chart is determined.

Lines 24-66: These lines comprise a Do/While loop, moving one row at a time through the table of Exhibit 6 to complete the necessary calculations for each of the operational parameters being used.

Lines 33-37: For each operational parameter, the formatting used in column B of Exhibit 1 is retained for use in Exhibit 7.

Lines 41-49: The value of the operational parameters from the second and third columns of Exhibit 6 is placed in the appropriate row in column B of Exhibit 1 in order to calculate the resultant IRR. These IRRs are then placed in the table of Exhibit 7 under the Low and High headings.

Lines 53-65: The last three columns of the table in Exhibit 7 are populated.

Lines 70-74: The table in Exhibit 7 is sorted and the title for the chart is prepared.

Lines 81-83: Values for the Category axis and the Value axis are specified.

Lines 85:88: Determine if a sheet entitled "Tornado Chart" already exists in the workbook. If it does, delete the sheet.

Lines 90-135: Create a new sheet entitled "Tornado Chart" and populate it with a stacked bar chart. The purpose for each of these lines will be

Exhibit 8

```
1  Option Explicit
2
3  Sub Tornado()
4  Dim x As Single, r As Single, lower As Single, upper As Single, base As Single
5  Dim columnactive As Single, rowactive As Single, rr As Single
6  Dim chartheading As String, ref As String, sortrange As Range
7
8  The ActiveCell must be the cell containing the name of the first parameter in the table of Exhibit 6
9
10 base = Range("b3").Value  'This is IRR for base case
11 lower = ActiveCell.Offset(-1, 1).Value  'The percentage below the base case
12 upper = ActiveCell.Offset(-1, 2).Value  'The percentage above the base case
13 columnactive = ActiveCell.Column
14 rowactive = ActiveCell.Row
15 ActiveCell.Offset(-1, 3).Value = "Low"
16 ActiveCell.Offset(-1, 4).Value = "High"
17 ActiveCell.Offset(-1, 5).Value = "Parameters"
18 ActiveCell.Offset(-1, 6).Value = "Min"
19 ActiveCell.Offset(-1, 7).Value = "Range"
20
21 Determine the number of parameters in the table and calculate the upper and lower case IRR for each one
22
23 rr = Application.WorksheetFunction.CountA(Range(Cells(rowactive, columnactive), Cells(100, columnactive)))
24 Do While ActiveCell.Value <> ""   'Loop thru each parameter in the table
25 r = Range("A:A").Find(ActiveCell.Value).Row   'Find the parameter name in the list of assumptions in column A
26 ref = "B" & r  'The cell containing the base case value for this parameter
27 x = Range(ref).Value 'This will be used to return the contents of this cell to its base case value
28 ActiveCell.Offset(0, 1).Value = x * (1 + lower)
29 ActiveCell.Offset(0, 2).Value = x * (1 + upper)
30
31 The formating in column B for each parameter will be retained in the table in Exhibit 7
32
33 Range(ref).Copy
34 ActiveCell.Offset(0, 1).PasteSpecial (xlPasteFormats)
35 ActiveCell.Offset(0, -1).Select
36 ActiveCell.Offset(0, 2).PasteSpecial (xlPasteFormats)
37 Application.CutCopyMode = False
38
39  'Change the active cell back to the top-left of the table and complete the table with low & high IRRs
40
41 ActiveCell.Offset(0, -2).Select
42 Range(ref).Value = ActiveCell.Offset(0, 1).Value  'Put the low case value from the table in column B
43 ActiveCell.Offset(0, 3) = Range("b3").Value  'Put the IRR for the low case into the table
44 ActiveCell.Offset(0, 3).NumberFormat = "0.0%"
45 Range(ref).Value = x  'Return the contents of this cell to its base case value
46 Range(ref).Value = ActiveCell.Offset(0, 2).Value
47 ActiveCell.Offset(0, 4) = Range("b3").Value
48 ActiveCell.Offset(0, 4).NumberFormat = "0.0%"
49 Range(ref).Value = x  'Returns the contents of this cell to its base case value
50
51 Columns 5-7 in the table will be what is needed to produce the chart
52
53 ActiveCell.Offset(0, 5).Value = ActiveCell.Value & " (" & Format(ActiveCell.Offset(0, 1).Value, _
54                                 ActiveCell.Offset(0, 1).NumberFormat) & ", " _
55                                 & Format(ActiveCell.Offset(0, 2).Value, _
56                                 ActiveCell.Offset(0, 2).NumberFormat) & ")"
57 ActiveCell.Offset(0, 6).Value = WorksheetFunction.Min(ActiveCell.Offset(0, 3).Value, _
58                                  ActiveCell.Offset(0, 4).Value)
59 ActiveCell.Offset(0, 7).Value = WorksheetFunction.Max(ActiveCell.Offset(0, 3).Value, _
60                                  ActiveCell.Offset(0, 4).Value) - _
61                                  WorksheetFunction.Min(ActiveCell.Offset(0, 3).Value, _
62                                  ActiveCell.Offset(0, 4).Value)
63 ActiveCell.Offset(0.6).NumberFormat = "0.0%"
64 ActiveCell.Offset(0, 7).NumberFormat = "0.0%"
65 ActiveCell.Offset(1, 0).Select
66 Loop
```

Exhibit 8 *(continued)*

```
67
68  Sort the table prior to constructing the chart
69
70  ActiveCell.Offset(-rr, 0).Select
71  Set sortrange = Range(Cells(rowactive, columnactive), Cells(rowactive + rr - 1, columnactive + 7))
72  sortrange.Sort key1:=Cells(rowactive, columnactive + 7), order1:=xlAscending, Header:=xlNo
73  chartheading = "Variable Range: " & Format(-lower, "0%") & " Below the Base Case to " & _
74                 Format(upper, "0%") & " Above the Base Case"
75  Call TornadoChart(rowactive, rr, columnactive, base, chartheading)
76  Worksheets("Analysis").Activate
77  End Sub
78
79  Sub TornadoChart(rowactive, rr, columnactive, base, chartheading)
80  Dim categories As Range, values As Range, chartrange As Range
81  Set categories = Range(Cells(rowactive, columnactive + 5), Cells(rowactive + rr - 1, columnactive + 5))
82  Set values = Range(Cells(rowactive, columnactive + 6), Cells(rowactive + rr - 1, columnactive + 7))
83  Set chartrange = Union(categories, values)
84  'If Tornado Chart already exist in workbook, delete it
85  Application.DisplayAlerts = False
86  On Error Resume Next
87  Sheets("Tornado Chart").Delete
88  Application.DisplayAlerts = True
89  'Create the chart and format it appropriately
90  ActiveSheet.Shapes.AddChart.Select
91     With ActiveChart
92        .ChartType = xlBarStacked
93        .SetSourceData Source:=chartrange
94        .PlotBy = xlColumns
95        .Location Where:=xlLocationAsNewSheet, Name:="Tornado Chart"
96     End With
97     With ActiveChart
98        .Move after:=Sheets("Analysis")
99        .HasLegend = False
100       .HasTitle = True
101            With .ChartTitle
102            .Text = chartheading
103            .Font.Color = RGB(153, 0, 0)
104            End With
105       With .Axes(xlCategory)
106            .TickLabelPosition = xlLow
107            .MajorTickMark = xlTickMarkNone
108            .TickLabels.Font.Size = 14
109       End With
110       With .Axes(xlValue)
111            .HasMajorGridlines = False
112            .TickLabels.Font.Size = 14
113            .TickLabels.NumberFormat = "0%"
114            .CrossesAt = base
115            .HasTitle = True
116                 With .AxisTitle
117                 .Caption = "Internal Rate of Return"
118                 .Font.Size = 14
119                 .Font.Bold = False
120                 End With
121       End With
122       .PlotArea.Border.LineStyle = xlSolid
123       .PlotArea.Border.Color = vbBlack
124            With .SeriesCollection(1)
125            .Format.Fill.Visible = msoFalse
126            .Format.Line.Visible = msoFalse
127            .Shadow=None
128             End With
129            With .SeriesCollection(2)
130            .Format.Fill.Visible = msoTrue
131            .Format.Fill.ForeColor.RGB = RGB(0, 0, 102)
132             End With
133    .ChartArea.Select
134    End With
135 End Sub
```

clear to a student that is familiar with the construction of charts in Excel. Using this macro as a template, the student can readily see how to use VBA to create other chart types and make desired cosmetic enhancements to the chart.

Conclusion

Sensitivity analysis in the capital investment appraisal process is essential. One tool that contributes to that analysis is a Tornado Chart. While not new, it is not heavily used due to the difficulty in constructing it. The skill set required is beyond that of the typical Excel user. Students need to have the ability to construct Excel workbooks that can include such items as Tornado Charts while accommodating a larger user base by making their workbook more user friendly. This paper illustrated how this can be accomplished by using VBA macros.

Note: The authors will be happy to make the workbook, including the macros, available upon request.

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Honest Hypothesis Testing: A Parable

Michael Stutzer
University of Colorado

Typical empirical methods training for finance Ph.D students emphasizes theory and application of statistical tools, augmented by study of empirical applications published in the academic journals. But newly minted faculty/authors will also have to cope with opinions of their administrative and academic journal evaluators, something not as heavily stressed in the heavily methods-oriented curriculum. We put a humorous slant on this by providing a parable in which a seemingly simple, standard hypothesis test is subject to the crucible of peer opinion both within and outside the professor's domicile. The parable is used to teach that the interpretation of seemingly simple test statistics is not so simple, and is intended to help instructors augment traditional statistics pedagogy.
Keywords: *Hypothesis testing, Bayesian methods, Ph.D econometrics training*

Introduction

An assistant professor of finance is asked by the department chair to analyze some data from a survey of the department's graduates. The department chair was most interested in the response to the survey question: "*Do you wish that you had studied finance somewhere else*"? Of the N = 400 respondents, 220 answered "no", while the other 180 did wish they had gone to school somewhere else. The department chair expressed relief that the fraction of "satisfied customers" was higher than ½, so released the data for use by the assistant professor (hereinafter referred to as "The AP"), who planned to use it and other findings in a paper intended for a finance education journal. Of course The AP assumed that the referee would also demand statistical significance of that finding and any others. Denoting the unobserved population fraction of the satisfied customers by θ, The AP decided to conduct the standard two-way hypothesis test:

$$H_0 : \theta = 1/2 \text{ vs. } H_A : \theta \neq 1/2 \quad (1)$$

Denoting the corresponding sample proportion by $\overline{\theta}$, under the null hypothesis the test statistic t is

$$t = \frac{\bar{\theta} - 1/2}{\sqrt{1/4N}} = \frac{(\frac{200}{400} - .5)}{\sqrt{1/(4*400)}} = \frac{.05}{.025} = 2 \quad (2)$$

standard deviations away from the standard normal distribution's mean of zero, resulting in the two-sided p-value of .0455, and hence statistically significant at the $\alpha = 5\%$ level. Augmented by other findings, the paper was then presented at a finance education conference. The AP expected the conference discussant to spend the designated 5 minutes flashing numerous slides listing many questions, e.g. What pains were taken to ensure that the sample was random and not affected by selection bias?; How was the exact wording of the question determined?; Did you examine conditioning variables that might affect the result, e.g. how many years it took the student to graduate?

The author was surprised to find that the discussant's sole recommendation was the following:

> "*The author should show a Bayes Posterior Odds Ratio for the null hypothesis*."

Only vaguely recalling a topic like that in an advanced Econometrics class, the author went to see an Old Geezer professor who was still willing to work on occasion. The Old Geezer quickly located a relevant article titled "Testing Precise Hypotheses", by the statisticians Berger and Delampady (1987). The Old Geezer said, "This kind of thing rarely appears in finance journals, so I'm not surprised that you didn't include it. I can explain this to you if you like." He then produced the following derivation:

Using Bayes' Theorem, he wrote

$$Prob[H_0|\ \bar{\theta} = .55] = \frac{Prob[\bar{\theta} = .55|\ H_0]PriorProb[H_0]}{Prob[\bar{\theta} = .55|\ H_0]PriorProb[H_0] + Prob[\bar{\theta} = .55|\ H_A]PriorProb[H_A]} \quad (3)$$

The $Prob[\bar{\theta} = .55|H_0]$ is the likelihood of the observed proportion, evaluated under the null hypothesis. So in this case, it is computed by evaluating the standard normal *density* evaluated at $t = 2$. Use the Excel function "NORM.S.DIST(2,FALSE)" to find that it is .054. The Old Geezer insisted that despite the department chair's implied belief that $PriorProb[H_0] = 0$, the conference discussant would want The AP to specify a prior belief that wouldn't result in a foregone conclusion. They agreed that the discussant would not object to setting $PriorProb[H_0] = 1/2$, so that $PriorProb[H_A] = 0$. But this still left unknown the term $Prob[\bar{\theta} = .55|H_A]$. Fortunately, Berger and Delampady (op.cit.) proposed a way to calculate that. The **average likelihood** for H_A averaged over some density $g(\theta)$ is defined to be

$$m_g(\bar{\theta} = .55) \equiv \int Prob[\bar{\theta} = .55|\theta]g(\theta)d\theta \tag{4}$$

Substitute all this into (3), take the reciprocal of both sides, and simplify to obtain:

$$\begin{aligned} &= \left[1 + \frac{PriorProb[H_A]}{PriorProb[H_0]} \frac{m_g(\bar{\theta} = .55)}{Prob[\bar{\theta} = .55|\theta = 1/2]} \right] \\ &= \left[1 + \frac{1}{\frac{Prob[\bar{\theta} = .55|\theta = 1/2]}{m_g(\bar{\theta} = .55)}} \right] \\ &\equiv 1 + \frac{1}{B} = \frac{B+1}{B} \end{aligned} \tag{5}$$

where the **Bayes Factor** B is defined to be:

$$B \equiv \frac{Prob[\bar{\theta} = .55|\theta = 1/2]}{m_g(\bar{\theta} = .55)} = \frac{.054}{m_g(\bar{\theta} = .55)} \tag{6}$$

Taking the reciprocal of (5) yields the simple representation for the Bayes posterior probability of the null hypothesis:

$$Prob[H_0 \,|\, \bar{\theta} = .55] = \frac{\mathrm{B}}{B+1} \tag{7}$$

So the **Bayes Posterior Odds Ratio** is

$$Odds\ Ratio \equiv \frac{Prob[H_0 \,|\, \bar{\theta} = .55]}{Prob[H_A \,|\, \bar{\theta} = .55]} = \frac{\frac{B}{B+1}}{1 - \frac{B}{B+1}} \tag{8}$$

The AP thereby learned that by specifying equal prior probabilities for the null and alternative hypotheses, the discussant's demand to see the Bayes Posterior Odds Ratio would be satisfied by producing the Bayes Factor B.

To compute (4), The Old Geezer proposed specifying a noncommittal uniform, i.e. constant, density $g(\theta) = 1$ for θ strictly between 0 and 1. He placed $t(\theta) = \frac{.55 - \theta}{\sqrt{1/4*400}}$ for each θ between .01 and .99 (spaced $d\theta = .01$ apart) in a spreadsheet column of 99 cells. In the next column, he approximated the integral in (4) by using the *NORM.S.DIST*($t(\theta)$,*FALSE*) function in Excel to evaluate it for $t(\theta)$ placed in the cell to its left, multiplied that by $d\theta = .01$, and summed the resulting column to approximate the integral in (4).

The AP left the Old Geezer's office, eager to duplicate the computations. This resulted in $m_g(\overline{\theta} = .55) \approx .025$. Substituting into (6) found $B = 2.16$. That is, the odds in favor of the null were better than 2:1. As a result, the posterior probability (7) of the null hypothesis was

$$Prob[H_0|\overline{\theta} = .55] = \frac{B}{B+1} = 2.18/3.18 \approx 69\% \quad (9)$$

"Drat", thought The AP, "The department chair would have been pleased to read that I statistically significantly rejected the null hypothesis. But the conference discussant's preferred procedure would require reporting something that favors the null hypothesis by better than 2:1 odds."

In desperation, The AP brought the results to The Old Geezer, along with some soul-searching questions:

First Question: "Isn't the p-value the probability that the null hypothesis is true ?"

First Answer: "No. In fact, the p-value is computed by *assuming* that the null hypothesis is true, so it can't provide evidence about that. In fact, you just told me that 69% is the probability that the null is true, not the far, far, lower p-value and critical value $\alpha = 5\%$".

Second Question: "Well, if we repeatedly randomly sampled $N = 400$ graduates from the same population, each time re-testing the null hypothesis, isn't the p-value the fraction of times that we would falsely reject the null hypothesis ?"

Second Answer: "No, it can't be that either: each time you re-tested you would wind up with a different p-value, none of which answer that question. You have a Ph.D and are paid more than me, so go do a Monte Carlo simulation to determine that fraction if you think it is so important."

Third Question: "Well, then what the Hell *is* the p-value ?"

Third Answer: "Neyman and Pearson weren't shlubs, and they despised Ronald Fisher's p-value. Maybe you should stop worshipping it. If you want to know what the critical value $\alpha = 5\%$means, they would assert that if you repeatedly randomly sampled $N = 400$ graduates with replacement from the same population, each time computing a $1 - \alpha$ confidence interval from the estimate $\overline{\theta}$ made with that sample, then about $1 - \alpha$ of those confidence intervals would contain the unknown value of θ. If you ever do that Monte Carlo study I suggested, you could check that claim, too. In the meantime, I'll show you a simple approximation you can use to approximate the associated posterior probability of the null hypothesis, when you assign 50-50 prior odds to it."

The Old Geezer limped back to the whiteboard to write that when $g(\theta)$ is a uniform density of width c much bigger than the standard error of estimate $\sigma_{\overline{\theta}}$ the approximate Bayes Factor B and associated posterior probability of the null $\frac{B}{B+1}$ are:

(Startz, 2014)

$$B \overset{c>>2\sigma_{\bar{\theta}}}{\approx} cNORM.S.Dist(t,FALSE)/\sigma_{\bar{\theta}}$$

$$Prob[H_0|\bar{\theta}] = \frac{B}{B+1} \overset{c>>2\sigma_{\bar{\theta}}}{\approx} \frac{NORM.S.Dist(t,FALSE)}{NORM.S.Dist(t,FALSE) + \frac{\sigma_{\bar{\theta}}}{c}} \quad (10)$$

The AP took formulae (10) back to the computer. Substituting the test statistic $t = 2$, the standard error of estimate $\sigma_{\bar{\theta}} = .025$, and the uniform prior's width $c = 1$ into (10) gives $B = 2.16$ implying 69% probability for the null. These formulae, found in Startz (op.cit.), produced results very close to what The Old Geezer found by approximating the integral on his spreadsheet. Using (10), The AP quickly discovered that setting $c = .25$ instead of $c = 1$ would yield a posterior probability of the null equal to only 35%, i.e. the alternative hypothesis would be favored by nearly 2:1 odds. That would surely please the department chair. But what if the discussant or a like-minded journal referee suspected that the corresponding [.375,.625] prior uniform density had been "c-hacked" to produce rejection of the null?

Split the Sample to Test More Proportions

Not wanting to waste any more time on esoteric statistical philosophy and associated Excel tomfoolery, The AP took a closer look at the rest of the survey, finding that responses were gathered from an equal number of men and women. The AP discovered that 114 of the 200 men were what the department chair deemed to be satisfied customers, while only 106 of the 200 women were. The AP quickly ran the test:

$$H_0: \theta_{men} = 1/2 \text{ vs. } H_A: \theta_{men} \neq 1/2 \quad (11)$$

The standard test statistic is $t = \overline{\theta_{men}} - 1/2 = \frac{114}{200} - 1/2 = .07$, which under the null is approximately normally distributed with mean 1/2 and standard deviation $\sqrt{\frac{1}{4*200}} = .0354$. The test statistic is thus 1.98 standard deviations from its hypothesized mean, i.e. statistically significant at the $\alpha = 5\%$ level (p-value = .048). Then The AP ran the same test on the women, finding $t = \overline{\theta_{women}} - 1/2 = \frac{106}{200} - 1/2 = .03$, which under the null is approximately normally distributed with mean 1/2 and standard deviation $\sqrt{\frac{1}{4*200}} = .0354$, i.e. too variable for statistical significance (p-value = .396).

The AP went to the Old Geezer with the good news:

"It is the men who are the statistically significantly satisfied customers, not the women. This in accord with the well-accepted Interplanetary Theory of Gender Differences: *Men are from Mars while Women are from Venus* (Gray, 2012). The Venusians communicate more effectively with each other than the Martians do.

So our female graduates must have more frequently shared their horror stories of pointless, pedantic PowerPoint slides flashed in class. This resulted in somewhat fewer satisfied customers than the taciturn men had. Moreover, the result is more statistically significant than our overall finding (p-value = .034 vs. .046)."

Eager to have a paper under review, The AP submitted this to a journal that had previously published related studies, without problematic Bayesian Hypothesis Tests. A surprisingly short but encouraging referee report arrived a few months later:

> "*As one of its co-creators, I am impressed with your interest in testing The Interplanetary Theory of Gender Differences. I only have one substantive request: please also use your data to conduct a Difference of Two Proportions test for the men and women*."

The AP thought, "More make-work. I already showed that the null was rejected for the men, but not for the women, in accord with the well-accepted (not to mention best-selling) Interplanetary Theory of Gender Differences. Now I have to perform another test. Well, it'll be worth it when it is accepted for publication."

After a night's celebration, The AP found a good applied statistics text—*Applied Statistics in Business and Economics* (Doane and Seward, 2012)—and found a description on pp.410-414 to ensure that the Difference of Two Proportions test was run properly. The following was quickly computed:

$$H_0{:}\theta_{men} = \theta_{women} \; vs. \; H_A : \theta_{men} \neq \theta_{women} \tag{12}$$

$$t = \frac{.57 - .53}{\sqrt{\frac{114 + 106}{400} * (1 - \frac{114 + 106}{400}) * (1 - \frac{1}{200} + \frac{1}{200})}} = .804 \tag{13}$$

$$p - value = .421 \tag{14}$$

The horror! The Difference of Two Proportions test adds the separate variances from the two separate tests. The resulting standard error is large enough to make the 4% difference in proportions statistically *insignificant*.

Multiple Comparisons

In desperation, The AP went to The Old Geezer with the bad news:
"I can't believe this crap. I did a perfectly good test that showed men were more likely than not to be satisfied customers, while women weren't. The referee liked

it, and asked for only one more test. But that test says that men and women weren't actually different, which flies in the face of the well-accepted Interplanetary Theory of Gender Differences. What do I do now ?"

The Old Geezer suggested that The AP look for other schools' surveys of finance graduates, to see if they offered any support for the Interplanetary Theory of Gender Differences.

The AP tasked a research assistant with calls to other finance departments, and eventually located four other departments that had conducted similar surveys, that also indicated the gender of respondents. Even better, the gender differences and sample sizes were both larger. The AP ran the Difference of Two Proportions tests for each of the four additional samples, finding p-values of .03, .08, .04, and .02, respectively. The AP's reply to the referee read as follows:

"I recognized that gender-specific findings from a single survey could be idiosyncratic. So I went to considerable effort to locate four other finance departments that had conducted similar surveys. Fortunately, they had much larger sample sizes. We applied your recommended Difference of Two Proportions Test to each, and found the gender difference to be statistically significant ($\alpha = .05$) in 3 of the 5 schools (their respective p-values were .421, .08, .04, .03, and .02). This provides some support for the Interplanetary Theory of Gender Differences."

The referee's reply was swift.

"*I commend your effort to find additional test data, and have no reason to doubt that it was randomly sampled independently from your own school's data. But I must question your interpretation of the significance level,* $\alpha = 5\%$. $1 - \alpha = 95\%$ *was the probability that you wouldn't falsely reject a true null about your own school. But now you have 5 separate null hypotheses. The probability that you won't falsely reject* ***any*** *of them when they are all true is* $(1 - \alpha)^5 = .774$. *So it is* ***as-if*** *you had raised your* α *from 5% to 22.6%. But this can be fixed, by controlling what is called the* ***family-wise error rate****. You must use a different level* α_g *that satisfies*

$$(1 - \alpha_g)^5 = 1 - \alpha \tag{15}$$

Now take the log of both sides, and because reasonable α *are pretty close to zero, you can use the approximation* $\log(1 - x) \approx -x$ *to find the* ***Bonferroni corrected*** $\alpha_g = \alpha / 5 = 1\%$. *That's the good news. The bad news is that none of your p-values are below 1%. Under the circumstances, I must recommend rejection of your paper*."

The AP was stunned by the sudden reversal of fortune, thinking:
"Perhaps The Old Geezer has a rejoinder to this. He knows this stuff, but I can't go back there until I do that Monte Carlo simulation he wanted. I don't have time

to go to Monte Carlo. Even if I did, I don't have enough travel funds to cover the cost. Doesn't The Old Geezer care that I need to publish or perish ?"

Facing the Music

The AP decided that academic Hara-kiri was the honorable way to end this, so made an appointment to see the department chair. After The AP described the fruitless process, the department chair said:

"I appreciate the Bayesian approach to testing, but was only interested in knowing whether *more than* half the graduates were satisfied customers. So why did you formulate the test with a point null that exactly half were? You should test:"

$$H_0 : \theta \leq 1/2 \text{ vs. } H_A : \theta > 1/2 \tag{16}$$

The AP agreed to do that. Looking back at equation (3), The AP saw that it was now essential to specify both $Prob[\bar{\theta} = .55 | \theta \leq \frac{1}{2}]$ and $Prob[\bar{\theta} = .55 | \theta > \frac{1}{2}]$. Again it made sense to assume a uniform prior distribution over all proportions θ between zero and one, in which case the Bayes Factor B would no longer be given by (6), but would become

$$B = \frac{Prob[\bar{\theta} = .55 | \theta \leq \frac{1}{2}]}{Prob[\bar{\theta} = .55 | \theta > \frac{1}{2}]} = \frac{\int_0^{1/2} NORM.S.DIST\left(\frac{.55 - \theta}{\sqrt{\theta(1-\theta)/400}}, FALSE\right) d\theta}{\int_0^{1/2} NORM.S.DIST\left(\frac{.55 - \theta}{\sqrt{\theta(1-\theta)/400}}, FALSE\right) d\theta} \tag{17}$$

$$\approx \frac{.00087}{.02391} = .036$$

The integrals were approximated by the same spreadsheet technique The Old Geezer used. Using (7), the posterior probability of the null in (16) is

$$Prob[\, H_0 \mid \bar{\theta} = .55] = \frac{B}{B+1} = .036 / 1.036 \approx 3.5\% \tag{18}$$

The AP emailed the result to the conference discussant who started this journey:

"Look at the difference between (18) and (9)! All I did was change from a point null at ½ to an interval null less than ½ , and the test result is radically reversed. The posterior probability that the null is true decreased from 69% to only 3.5%, which is pretty darn close to the much-maligned p-value in my original test (p = 4.6%) ! I plan to add the department chair as a co-author when I submit this for publication. Sure I did all the hard work, but nobody cares how many co-authors there are, so it can only help my career."

Relevance for Academic Finance Research

That ends this parable on an optimistic note, but I hope it doesn't end your advocacy for meaning and truth in empirical work. The problems highlighted can and have appeared in academic finance research. Let's consider the conflicting results between classical hypothesis tests and Bayesian Posterior Odds ratios that were highlighted in Section 1. French [p.59, 1980] examined day-of-the-week stock market returns, and used classical hypothesis tests to conclude that "the hypothesis that Monday's expected return was positive can be rejected during any five-year period at a 5 percent significance level." Yet Connolly (1991, pp.77-78) calculated Bayesian Posterior Odds ratios for two-tailed tests of the hypothesis (1), i.e. that the fraction of positive Monday returns was ½, over many of the same years examined by French, and concluded that "Posterior Odds favor the hypothesis of an equal percentage of positive and negative returns except in a few years." This is the phenomenon illustrated in Section 1 herein. Connolly (op.cit.) did not report posterior odds ratios for the hypothesis (16), but had he done so, he might have found results analogous to those reported in Section 4 herein.

Now let's consider the multiple comparison problems highlighted in Section 3. You may think that when only one data set is used, the analysis can't be affected by the multiple comparisons problem that plagued The AP's analysis of the four additional surveys' findings. But suppose you obtained a data set containing dozens of possible variables that might help explain the variation in a single independent variable. You run the usual ad-hoc (usually linear) multiple regression, which uncovers one or more variables with p-value lower than 5%. Perhaps "the literature"' has an "explanation"' for the non-zero coefficient(s) on the variable(s), although that (social science) theory likely will not have the inherent testability (i.e. easily falsified) and prior plausibility of a respected physical theory (e.g. Einstein's Relativity Theory). If the social science literature does not provide a suitable explanation, you attempt to devise one. Perhaps your subsequent working paper described this process in reverse order, starting with a section titled "Hypothesis Development" that includes this explanation along with alternatives to be tested in an empirical section that follows. In that section, you further explored the nature of the relationship with more modeling and testing, in an exploratory process contingent on the results of hypothesis tests reported earlier in the paper. This modus operandi is so common that few give it a second thought. But statisticians have identified this "garden of forked paths" as a source of multiple comparison problems (Gelman, 2014). The AP did this when turning to the gender difference in the data, only after having seen the problematic posterior odds ratio, but did not reduce the critical value α in light of the multiple comparison.

In finance, this process has been writ large by countless publications advocating candidates for additional factors in multiple linear factor models, each of which purports to explain the cross section of stock returns better than other linear factor

models (e.g. the CAPM). A recent paper carefully analyzed the multiple comparison problems resulting from this decades-long mining of ubiquitous returns databases, and concluded:

"The estimation of our model suggests that a newly discovered factor needs to clear a much higher hurdle, with a t-ratio greater than 3.0. Echoing a recent disturbing conclusion in the medical literature, we argue that most claimed research findings in financial economics are likely false." (Harvey, Liu, and Zhu, 2016)

The ubiquitous "robustness tests" that are reported in regression-based articles that appear in academic finance journals are the typical response to those concerns. But the usual process only displays a small fraction of the plausible alternative specifications of analogous independent and dependent variables, and functional forms that could have been mandated in the reviewing cycles. Three prominent business school faculty have proposed a promising alternative. Simmons, Nelson, and Simonsohn (2015) propose using computer power to simultaneously examine thousands of such alternative specifications. They devised graphical tools to display the array of results, and utilized a clever bootstrap procedure to test whether or not an author's highlighted effect is outside the range of results that would be expected using thousands of alternative specifications that by construction, contain no such effect.

I hope that you will implement and teach such procedures, and that the academic finance journals will eventually insist on them. Until then, articles in journals of high repute should not receive a free pass. As noted by Velickovic (2015):

> "A critical approach must exist regardless of the journal in which the paper is published."

In addition to raising awareness during empirical methods training, faculty can provide other concrete recommendations for more honest hypothesis testing when devising exercises for students. For example, an instructor could describe the nature of a multivariate data set before providing it. Then before providing the actual data, the instructor could make students commit to performing one (and only one) multiple linear regression and one specific hypothesis test for a single, pre-determined coefficient H_0: $\beta = \beta_0$ *vs.* $H_A : \beta \neq \beta_0$, stating a plausible motivation for testing that specific hypothesis. At a minimum, insist that the students choose an interval of length c centered at β_0, with c equal to 10 times the reported standard error $\sigma_{\bar{\theta}}$ of the estimated coefficient, to enable use of (10). Then train the students to plug the t-statistic for the null, c, and $\sigma_{\bar{\theta}}$ into (10) to compute the Bayes Factor and corresponding posterior probability of the null hypothesis. In addition to reporting the usual t- statistic, counsel the students to report that this posterior probability arose both from the data and the prior uniform density over the range $[\beta_0 - c / 2, \beta_0 + c / 2]$.

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What are the Effects of Employer-Sponsored Financial Education on Participants in Defined Contribution Plans?

Nancy Lottridge Anderson
Mississippi College

Magdy Noguera
University of Idaho

We design a curriculum to educate employees about their retirement plan and test the effects of the education using surveys, t-tests, and multivariate regressions. Our goals are to increase knowledge about the plan, increase participation rates, and increase contribution rates. We employ regression models to determine the effects of age, term of service, salary, status, and employer match on contribution rates for each year and the change in contribution rate from 2013 to 2014. We find participation rate increased by 2.21%, while there was no significant difference in contribution rates. Results of the regressions show contribution rates depend on age, salary, status and employer match. Change in contribution rate depends on term of service. Newer employees were more likely to increase their contribution rate from 2013 to 2014. Results of the survey show changes in overall knowledge of the plan and an increase in employee perception of plan knowledge.

Keywords: *Retirement Education; Financial Literacy; Savings Behavior; Defined Contribution Plans; Fiduciary Responsibility; ERISA educational guidelines.*

JEL Classification: *J32, G02, H31, I21, I22, I23, M53*

Introduction

ERISA guidelines are being tested in court in the area of financial education. Employers are required to provide adequate education to employees regarding defined contribution plans but have been depending on third party providers to meet this requirement. While providers offer print and online educational information, many employees are uncomfortable dealing with a third party and express confusion and dissatisfaction with their plans. Though many employers are unprepared to offer financial education, they still face liability in the case of ill-

informed employees. Employers must develop an educational policy for defined contribution plans and must document all actions to comply with the law.

The question remains whether such educational offerings have an impact on employee behavior. We ask the question, "What are the effects of employer-sponsored financial education?" To test this, we first develop a curriculum spanning the academic year. Each month, we focus on a different aspect of financial literacy. We design the retirement education as if it were a university course, calling the program, "Retirement 101," and developing a course website within our current system.

We use a variety of methods to communicate to employees and educate them about finance, in general, and our retirement plan, in particular. Emails, mailbox flyers, and flyers placed around campus highlight the concept of the month. Face-to-face seminars cover topics on financial planning and investment selection. YouTube videos and recorded lectures are available for employees who prefer to access information on their computers. A rotation of PowerPoint slides are shown on monitors on campus. We also set up a Facebook page.

We have three goals: 1) increase knowledge about the plan, 2) increase participation rate, and 3) increase contribution rate. We measure the success of the program through two voluntary surveys, and we collect data for the beginning and end of the year on participation and contribution rates. In addition, we construct regression models to test the effects of age, income, term of service, status, and employer match on contribution rates. We also use a regression model to test the effects of the same variables on change in contribution rates across the two years.

We find an increase in participation of 2.21%, but median contribution rates for the two years remain at 6.00%. In addition, there is no significant difference of means in contribution rates across the two years. Multivariate regression for both years reveals that contribution rates depend on age, salary, status and employer match. When the dependent variable is the change in contribution rate across the two years, the only significant variable is term of service. Newer employees were more likely to change their contribution rate during the period when the educational program was ongoing.

General knowledge of the plan increases in two out of four areas. Self-rating in the two surveys shows employees' perception of their knowledge increases. Median perception (based on a 1 to 10 rating) is 4 in 2013 and 6 in 2014. Through comments on the survey, employees express their appreciation for the educational program.

Literature Review

The Employee Retirement Income Security Act (ERISA) passed in 1974 as a protection for workers in defined benefit plans. At that time, 92% of employers

surveyed provided this type of retirement plan, but the burden of funding and administration created by the new law resulted in a decline in defined benefit plans. This coincided with the creation and rise of the 401(k) or defined contribution plan.

Employers began to "freeze" old defined benefit plans and transition to defined contribution plans. Per a survey of employers in 2008, 42% provide both a defined benefit plan and a defined contribution plan, while 56% only provide a defined contribution plan. While many of the new plans offer a match, employees must depend on salary deferrals to provide the necessary income in retirement (Cotter, 2009).

By 2006, only 20% of employees had a defined benefit plan, while 12% had both a pension plan and a defined contribution plan. Defined contribution plans have become the plan of choice for many employers, and employees bear the risk for retirement savings. In defined contribution plans, participation is voluntary. In 2006, 20% of eligible workers chose not to participate in their company's defined contribution plan (Purcell & Whitman, 2007).

Currently, participant-weighted participation rate in 2013 for defined contribution plans is 67%, while the average voluntary contribution rate is 7.0%. The median contribution rate is 6.0% for the same period and has remained at this rate for the past five years. Average account balance for all ages is $101,650, while the average balance for employees 55 to 64 years old is $180,771. Only 10.5% of employees have balances greater than $250, 000 (The Vanguard Group, 2014).

Pfau and Kariastanto (2012) calculated retirement returns and withdrawals to estimate an appropriate savings rate for employees. They said that saving 16.6% each year for 30 years will be sufficient to replace pre-retirement income. Based on current data, savings rates among Americans are inadequate.

With the change in retirement plans and the burden now being placed on employees to save and invest on their own, education becomes the key to changing behavior among this group. Hilgert, Hogarth, and Beverly (2003) found low scores for financial literacy among the general population, with younger groups and minority groups scoring even less. They found a connection between financial education and behavioral changes. When it comes to changing employee behavior towards their retirement plan, education alone may not be enough, though.

Olsen and Whitman (2007) said that plan design and in-house financial education must be combined to achieve the best savings rates among employees. Critical elements of the design include plan menu, employer match, enrollment options, and withdrawal options. Workman (2012) also pointed to this combination of plan design and employee education to achieve goals but said the focus should not be on participation rates but on appropriate funding of retirement.

According to Dulebohn and Murray (2007), employer-sponsored education may result in greater employee satisfaction with defined contribution plans. The National Bureau of Economic Research (2013) studied employees who attend

employer-sponsored educational programs and found improvements in general financial literacy and in retirement planning. Beck (2010) studied employees under the same conditions and finds an increase in confidence and even improvements in overall job performance.

Finally, Lawton (2013) proposed developing an educational policy that outlines sessions and expectations. The goal should be to encourage attendance and participation among employees and said such a policy may avert future lawsuits from participants.

Current Plan

Mississippi College is a private four-year university with more than 5000 students. In 2013, we had 535 full-time employees, and in 2014, we had 555 full-time employees. In both years, less than 40% are faculty members. The median salary for staff for both years is around $35,000, while the median salary for faculty is around $55,000.

Before 2002, the college provided a defined benefit plan for employees. At the end of the calendar year, a freeze was placed on this plan, and new contributions began to flow to a new defined contribution plan. All new employees have only the defined contribution plan. Employees with longer terms of service have the frozen defined benefit plan and the new, active defined contribution plan. There are 197 active employees with funds in both plans.

As part of the agreement to transition to the new type of plan, Mississippi College began contributing 7% to the defined contribution plan for every full-time employee. This is based on salary and is not a deferred amount or a matching amount. Employees who do not participate in voluntary deferred contributions still have 7% each year going into a retirement plan. The employer has a five year vesting schedule for this contribution.

Employees who have been with the college for more than five years have the opportunity for a matching contribution of 1%. This is in addition to the 7%. After ten years, the match increases to 2%, and after fifteen years, it increases to 3%. An employee working for the college longer than fifteen years may contribute 3% and receive a total of 10% in employer contributions. The average term of service for 2013 was 9.77 years, while the average term of service for 2014 was 10.85 years.

Because of the 7% employer contributions, participation in the voluntary plan is low. Prior to the education offerings, only 125 employees opted for salary deferral into the voluntary plan. This represents a participation rate of 23.36%.

Two companies are approved to receive contributions to the retirement plan: 1) TIAA-CREF and 2) Guidestone. All employer contributions are deposited into TIAA-CREF accounts. Employees must choose between the two companies for their voluntary contributions. Each company offers a comprehensive plan menu.

Each offers online educational content, and each schedules site visits to handle employee questions.

Curriculum

Faced with the growing requirements for employee education on retirement planning, the retirement committee for the college appointed a subcommittee to develop an in-house educational program. The subcommittee was composed of one faculty member and three staff members and was tasked with the development, implementation, and documentation of the curriculum.

As an educational institution, we decide to apply the resources and methods used in our regular classes. We design a curriculum to meet our objectives and plan for the content to be disseminated over the academic year. Each month, we focus on a different concept or question. We have objectives for each topic, and each is addressed using a variety of media.

From our survey, we find a lack of knowledge about the current retirement plan among this group. Per employee comments, this lack of knowledge extends to general financial principles. As such, we decide to expand our offerings to include topics on personal finance and Social Security. The regional Social Security representative came on campus and conducted seminars as part of the process. Below is the basic course outline:

August	Administer beginning survey.
September	What does my employer do for me?
October	What can I do for myself?
November	How do I find the money to contribute?
December	How do I sign up?
January	Which funds do I choose?
February	How much money will I need?
March	Will Social Security be there for me?
April	What happens when I retire?
May	Do I know the answers now?

The first face-to-face set of meetings was for employees who are participants in the old defined benefit plan. Because of the lack of communication about the health of the plan, employees were frustrated and, in some cases, quite angry. The purpose of this meeting was to address concerns and alleviate fears. This "clearing of the air" was necessary before we could proceed with further retirement education. The meetings were well-received.

We use a variety of methods to deliver course content. Retirement 101 was set up as an open course through our Moodle system. A Facebook page was set up for the course, as well. Communications about retirement information and educational

opportunities appeared on these sites. In addition, we sent out campus-wide emails and individual postal fliers.

We offer five face-to-face educational sessions. These were optional for employees. Appendix B details the sessions and attendance. YouTube videos were recorded on various topics as a way to deliver online content. Views for each are also in Appendix B.

Screens around campus were used to emphasize the "topic" of the month. The goal of each presentation was to focus on one topic in a fun and personal way. Fliers were also posted around campus.

Data and Methodology

Before Retirement 101 began, we administered an optional survey. At the time, nearly 40% of employees completed this exercise. Four general areas of knowledge of the plan were tested: 1) amount of employer non-deferred contribution, 2) amount of employer match, 3) vesting, and 4) guarantee of income. In addition, respondents were asked to rate themselves on a scale of one to ten as to their knowledge of the plan.

To gauge employee involvement, three additional questions are asked. Employees are asked to give a range for the number of times they visit the website of the plan administrator. They are also asked to pinpoint the last time they checked beneficiaries on their plan. Finally, they are asked to supply their deferral percentage. This information was used to enhance education. Finally, employees indicate whether they are staff or faculty, and they list their ages. They also supply their term of service and estimate a retirement date.

At the end of Retirement 101, the same survey was administered again. Participation was much lower, with about 10% responding. A total of 13 questions were on the survey. The thirteenth question was open-ended and allowed for comments. The survey was administered electronically, and campus-wide emails prompted employees to participate. Appendix A contains the questions on the survey. Table 5 contains the results of the two surveys.

Human Resources keeps data on participation and contribution rates. While we have monthly data, we decide to use two snapshots: 1) before the start of the educational program, and 2) after the completion of the educational program. Table 1 lists mean and median contribution rates by year and by quartile. Table 1 also contains information on participation rates for 2013 and 2014. Statistics are calculated on the entire population of employees for each year.

We conduct a means difference test on contribution rate for 2013 and 2014. Between those two years, new employees were added while others left. The means testing was done only on the common set of 511 employees. Table 2 reports the results of the test, using the Satterthwaite method.

Finally, we develop two regression models using data provided by Human Resources. Independent variables include age, term of service, staff, voluntary match, and salary. We use a binary variable for staff versus faculty. For the first regression, the dependent variable is contribution rate. This model is tested for each year. For the second regression, the dependent variable is the change in contribution rate across the two years. Below are the two models:

$$ContRate_{2013-2014} = a + b_1 Age + b_2 TermofServ = b_3 Staff = b_4 VolMatch = b_5 Salary = e \quad (1)$$

$$\Delta ContRate = a + b_1 Age + b_2 TermofServ + b_3 Staff + b_4 VolMatch + b_5 Salary + e \quad (2)$$

Where
ContRate = 2013 contribution rate or 2014 contribution rate
Δ*ContRate* = change in contribution rate from 2013 to 2014
Age = age of employee at the end of the year
TermofServ = time of employment at the end of the year
Staff = binary variable with 1 being staff, 0 being faculty
VolMatch = percentage of voluntary match
and
Salary = salary of employee at the end of the year

All regressions are tested with the common set of 511 employees. Summary statistics for independent variables are reported in Table 3. Results for both multivariate models are reported in Table 4.

Results

In 2013, there are 535 employees, and 125 participate in the voluntary deferred contribution to the retirement plan. This represents a participation rate of 23.36%. Among this set, the mean contribution rate is 9.10%. In 2014, there are 555 total employees, and 143 participate in the voluntary plan. This represents an increase of 2.21%.

Table 1. Contribution Rates and Participation Rates for Retirement Plan for 2013 and 2014.

	2013	2014
Quartile 1		
Mean Rate	1.74%	1.74%
Median Rate	2.00%	2.00%

Table 1. *(continued).*

	2013	2014
Quartile 2		
Mean Rate	4.16%	3.94%
Median Rate	4.00%	4.00%
Quartile 3		
Mean Rate	8.42%	7.81%
Median Rate	8.00%	8.00%
Quartile 4		
Mean Rate	21.69%	21.09%
Median Rate	20.00%	18.00%
Mean Annual Contribution Rate	9.10%	8.56%
Median Annual Contribution Rate	6.00%	6.00%
Total Number of Employees	535	555
Total Number of Participants	125	143
Participation Rate	23.36%	25.57%

Mean and median contribution rates for 2013 and 2014 are presented. Contribution rates for each year are broken down by quartiles. After ranking all employees by contribution rate, quartiles are set by dividing each year's total into four groups. Quartile 1 is the group with the lowest contribution rate. Mean and median rates are calculated on non-zero voluntary rates. Participation rate for each year is also shown.

While there was an increase of 20 employees during this time, none of the new employees chose to participate in the deferral plan, and six contributing employees departed. The net result is that 24 existing employees began contributions to the voluntary plan during the year. From 2013 to 2014, we increased the participation rate in the Mississippi College retirement plan.

In 2014, the mean contribution rate among participating employees declined to 8.56%, but the median contribution rate remained at 6.00%. This matches national median contribution rates. Statistics for all quartiles are similar for the two years. Table 2 contains the results for the means testing for contribution across the two

years. Only active employees for both years are included in this test. There is no significant difference in the mean contribution rate from 2013 to 2014. Based on this data and the t-test, we did not increase the contribution rate.

Table 2. Means Testing for Retirement Contribution Rates across two years: 2013 and 2014.

Year		
2013		
Mean Contribution Rate	2.1973%	
Standard Deviation	(5.8593)	
Minimum Cont. Rate	0.00%	
Maximum Cont. Rate	48.00%	
2014		
Mean Contribution Rate	2.3205%	
Standard Deviation	(6.2637)	
Minimum Cont. Rate	0.00%	
Maximum Cont. Rate	68.00%	
Difference of Means Test	**t Value**	**Probability > t**
Satterthwaite	-0.32	0.7453
Number of Observations	511	

Contribution rates for each employee for the years 2013 and 2014 are tested for a difference in means. Difference in means for all employees for voluntary contributions is tested. Means and standard deviation for the entire population for each year is reported. Standard deviations are reported in parenthesis. Three methods of means testing are applied, with t-values and probabilities reported for each variable.

Table 3 contains the summary statistics for the two multivariate models. The mix between staff and faculty remains the same for the two years. Age and salary decline slightly from 2013 to 2014, while term of service increases slightly. The mean voluntary contribution for all 511 common employees is 1.0720% and increases to 2.3205%. By this measure, contribution rates increased from 2013 to 2014. In addition, the mean change in participation rate is 0.1233%, also suggesting this goal was met.

Table 3. Summary statistics of data used in regressions.

Variable	Number	Mean	Std. Dev.	Minimum	Maximum
2013:					
Age	511	47.88	12.8263	22.00	74.00
Term of Service	511	9.77	9.59	0.00	43.70
Salary	511	51,846.58	30,988.65	0.00	237,504.00
Voluntary Contribution	511	1.0720	0.7864	0.0667	4.1695
Faculty versus Staff	511	0.5969	0.4910	0	1
2014:					
Age	511	48.88	12.8263	23.00	75.00
Term of Service	511	10.85	9.59	1.0833	44.7833
Salary	511	49,700.34	31,575.23	2,000.00	277,504.00
Voluntary Contribution	511	2.3205	6.2637	0.00	68.00
Faculty versus Staff	511	0.5969	0.4910	0	1
Change in Participation	511	0.1233	4.1584	-31.00	68.00

Summary statistics for all observations are presented below by year. The number of observations along with mean values for age, term of service, salary, and voluntary match are presented. Change in participation rate from 2013 to 2014 is listed with the 2014 variable. The mean value for the binary variable for faculty versus staff is also presented. Standard deviation, minimum and maximum values are presented for each variable.

Table 4 contains the regression results for Model (1) for each year. In both years, age is positive and significant at the 1% level. Older employees contribute more to their retirement plan. The binary variable for staff is negative and significant. Staff are less likely to contribute to the retirement plan. Voluntary match is positive and significant for both years. From this, we see that the greater the employer match offered, the greater will be the contribution rate. Salary is positive and significant for both years, but the coefficient is quite small. Term of service displays significance only in 2013.

Table 4. Regression Results for 2013 and 2014.

	2013 Model 1	2014 Model 1	2013 to 2014 Model 2
Intercept	-2.77031***	-2.94426***	-0.25189
	(-2.35)	(-2.32)	(-0.29)
Age	0.08650***	0.09987***	0.00926
	(3.70)	(3.89)	(0.52)
Term of Service	-0.07932*	0.03737	-0.05534**
	(-1.89)	(-1.40)	(-2.13)
Salary	0.00002176**	0.0000879***	0.00000611
	(2.50)	(3.35)	(1.03)
Voluntary Match	1.19959***	0.60989**	0.11062
	(3.72)	(2.10)	(0.55)
Staff	-1.10389**	-1.59330***	0.21938
	(-2.09)	(-2.70)	(0.54)
Observations	511	511	511
F-Statistic	16.61	10.96	1.22
R-Square	0.1413	0.0979	0.0119
Adjusted R-Square	0.1328	0.0890	0.0021

This table presents multivariate regression results for the regression model for each year where the dependent variable is the contribution rate of the employee. Multivariate regression results where the dependent variable is the change in contribution rate from 2013 to 2014 are also presented. T-values are reported in parentheses. Statistical significance is displayed by the use of one (10 percent), two (5 percent), or three (1 percent) stars.

Model (2) yields different results. When the dependent variable is change in contribution rate, the only variable displaying significance is term of service. It is negative and significant at the 5% level. This indicates newer employees are more likely to increase their contribution rate during the time period. Newer employees may have responded to the educational program.

Table 5 contains the survey results for both years. There is a sharp decline in number of respondents which may skew results. The first survey was administered at the beginning of the academic year, while the second was administered at the

end of the year. The latter time is filled with final exams and reporting deadlines, and this may have dampened response.

Table 5. Pre and Post Education Survey Results for 2013 and 2014.

Question	Percentage Correct	
Knowledge of the Plan:	Pre-education	Post-education
Employer non-deferred contribution	51.94%	69.09%
Employer match	44.66%	38.18%
Vesting	44.17%	72.73%
Guarantee of Income	52.91%	47.27%
Perception of Knowledge of the Plan:		
Self-rating		
Mean	4.248	5.000
Median	4.000	6.000
Number of Respondents	206	55

This table presents results of the pre and post surveys taken to test knowledge of the retirement plan. Four questions test general knowledge of the plan. Percentage correct for each is given. A fifth question tests participant perception of knowledge of the plan. Respondents were asked to rate their knowledge of the plan on a scale from 1 to 10. Mean and median ratings are presented.

In testing knowledge of the plan in four areas, percentage correct increased dramatically in two areas: 1) amount of employer non-deferred contribution and 2) vesting. There was a slight decline in two areas: 1) amount of employer match and 2) guarantee of income. While the results are mixed, this shows an increase in knowledge of the retirement plan among employees from 2013 to 2014.

The survey reveals the biggest change among employees across the two years may be perception of knowledge. Median rating in 2013 was 4 and increased to 6 in 2014. From this, employees appear more confident in their ability to direct their retirement planning.

Employees were given opportunities on each survey for open-ended comments. Before the program began, comments included, “I just realized, after answering these questions, how much I don’t know...,” “I wish a representative from the plan

was available to discuss what are (the) best option(s) for me. Only thing I ever received was a packet that guided me to the website. I don't really know what is best for me. All I can do is just guess that I have what I need," "Other jobs I've had at least had a rep available to meet to discuss status," and "increase the match." Employees asked for more information through face-to-face meetings, newsletters, emails, etc. and asked for "More discussion about (the retirement plan)."

On the second survey, comments included, "I was not able to attend the seminars this year because of location but am looking forward to attending in the future. The very fact that information was made available online was helpful," "I have appreciated the retirement info this year very much! Thank you!!!!,(I) have learned things that (I) didn't know that (I) didn't know so even though I do not think of any ideas or suggestions, I am sure that there are still things that I need to learn!," and "You guys are doing a great job! All the communication regarding retirement information has been very helpful." Employees commented on the use of online videos and asked for more contact with plan administrators. Many asked for additional sessions and continuing education.

Conclusions

Employers have been dependent on third-party administrators to provide employee education on their retirement plans. Since ERISA requires the provision of educational opportunities, employers must find a way to supplement educational programs and document those efforts. As such, we design an in-house educational curriculum for our defined contribution plan and test the impact of the plan on participation rates, contribution rates and overall plan knowledge.

We find that older employees and employees with higher salaries are more likely to contribute to their retirement plan. Staff employees are less likely to contribute. The employer match has a positive and significant impact on contribution rates. The result on this one variable offers a solution to low participation rates and low contribution rates. As one employee commented, simply, "increase the match."

After a year-long educational program targeting general financial literacy and retirement planning, we ask the question, "What are the effects of employer-sponsored financial education on participants?" We find the participation rate increased by 2.21%, but the median contribution rate remains the same. Knowledge of the plan increased in two of four areas, and employees report an increase in perception of knowledge (rating) from 4 to 6.

When testing a regression where change in contribution rate is the dependent variable, we find newer employees more likely to increase their contribution rate. From employee comments, we see an appreciation for the educational offerings and requests for further education in this area.

Our first attempt at financial education was called Retirement 101, and we have seen measurable changes in employee participation rates and knowledge.

More than that, we note the change in perception among employees and have noted the improvement in the relationship between employer and employee when it comes to the retirement plan. In addition, the regression results indicate a change in plan design that improves the employer match may improve participation and contribution rates. Combining this with in-house financial education may produce the best results in employee savings and attitudes toward retirement planning.

We plan to offer Retirement 101 on an ongoing basis, with special efforts on educating new employees. We will continue to survey employees and monitor participation and contribution rates to see if repeated exposure makes a measurable difference in employee behavior.

Finally, we are gathering information on the cost to change the plan design to increase participation and contribution rates. Results of the regression and cost of design changes will be presented to the administration for consideration.

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Appendix A. Survey Questions for 2013 and 2014

Below is the entire set of questions for the survey. This survey was administered before the retirement education took place and again at the end of the education program.

1. Are you Staff or Faculty?

2. What is your age?
   Respondents were given decades long ranges from which to choose.

3. How long have you been at MC?
   Respondents were asked to choose between less than 5 years, 5-10 years, 10 to 20 years, and more than 20 years.

4. When is your estimated retirement date?
   Respondents were given the options of less than 5 years, within 10 years, within 20 years, and longer than 20 years.

5. Based on a scale of 1 to 10, rate your knowledge of the MC retirement plan.

6. How often you visit the plan website?
   Respondents were asked to choose between never, rarely, a few times a year, a few times a quarter, and every day.

7. True or False. The current MC retirement plan will pay me a guaranteed monthly amount when I retire.
   Answer: False

8. What percentage does MC contribute to your retirement whether or not you personally contribute to the plan?
   Answer: 7%

9. The match provided by MC is dependent on years of service and contribution amount. What is the maximum percentage match that MC will contribute to a retirement plan?
   Answer: 3%

10. How much is currently being deducted from your paycheck to contribute to the MC retirement plan?

11. When was the last time you checked the beneficiaries of your plan? Respondents were asked to choose between never, last month, last year, within the last 5 years.

12. How many years must you work at MC before the balance in your account is fully yours?
Answer: 5 years

13. How can we help you prepare for retirement? Do you have any ideas or suggestions to improve retirement education, the retirement website, retirement forms, etc.?

Appendix B. Participation Tallies for Educational Offerings

Type of Presentation	Number of Participants/Views
Face-to-Face:	
Defined Benefit Plan (now frozen)	40
Personal Finance	98
Plan Menu Education	29
Website Education	40
Social Security	35
Online Presentations:	
How Do I Sign Up? (forms and process)	39
Two Options: TIAA-CREF and Guidestone	86
Sample Paycheck: How deferral affects take- home pay.	86
16.6%: How much should you save?	4
Match: What is the employer match?	14

This table lists the face-to-face and online presentations offered as part of the educational program for the retirement plan. Number of participants in each is listed.

Advances in Financial Education Winter 2016