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Art of Econ: Incorporating the Arts through Active Learning Assignments in Principles Courses

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ABSTRACT

Research has shown that, at the principles level, economics education relies predominantly on lectures for teaching. Introducing differentiated teaching by leveraging active learning provides a way for economics educators to increase students overall understanding and to assess competency at a higher level. In this paper, we provide instructors with a range of active learning assignments with relatively low costs for all participants. These assignments utilize a variety of economics-themed creative projects, which require students to determine which information is essential, use economics language clearly and precisely, and create deliverables that engage the audience with classroom material using an innovative approach.

Introduction

Over the past two decades, economics educators have had a renewed interest in incorporating new and innovative teaching methods that go beyond the traditional lecture based model. Although instructors of economics continue to rely heavily on traditional lectures, there is a growing movement towards teaching techniques that engage students and improve learning outcomes (Harter, Becker and Watts, 1999). Cooperative learning, active learning and project-based learning have received attention for their ability to increase student learning.[3] Active learning provides a pathway for economics educators to differentiate their teaching methods, increase the depth of learning for their students, and assess a higher level of understanding of economics concepts.

Introducing new projects can be costly to the instructor or students (sometimes both) and may reduce the willingness of educators to differentiate their teaching methods. To help reduce the cost of introducing differentiated projects into their courses, we supply economics educators with a tool-box of lower cost approaches to engage students. These projects will help instructors introduce differentiated learning into their courses, building upon the foundation of active learning and innovative teaching methods. By incorporating differentiated learning techniques, faculty can create a more inclusive learning environment, addressing the needs of all students by varying the method of assessment. Students that traditionally underperform on multiple-choice exams are able to express their knowledge of economics content in a different context.[4] We specifically introduce fun, creative and artistic assessment methods that are the least costly, in both time and money, for both instructors and their students.[5]

An additional motivation for this paper is the hope to increase diversity in students majoring in economics. Siegfried (2010) finds that there has been a decline in economics degrees awarded and this may be attributed to female students being less likely to major in economics. Females account for 58.5% of all undergraduate degrees awarded, but in contrast women earn only 31% of degrees in economics. In addition,

due to its analytical structure, it is evident that interest and success in economics is often a function of personality type (Ziegert 2000). Stowe (2010) suggests that changing the instructional method may attract different personality profiles to the field of economics. Since researchers agree that females have different learning styles relative to males (Lage and Treglia 1998) and that diversifying the teaching methods help attract a more diverse student body, we argue that it is also important to implement differentiated learning methods to both enhance student learning and to attract a greater number of females, as well as a variety of personality types, to the study of economics.

Literature Review

We provide plenty of support for instructors to adopt differentiated pedagogy methods. We focus our literature review on the importance of active learning and how the use of arts in economics has evolved over time. Art is defined as the expression or application of human creative skill and imagination that can be branched into creative activity, such as painting, music, literature, and dance. There has been an increased movement towards adopting active learning techniques that incorporate art in economics classrooms. To help students reach a higher level of understanding, Hoyt (2003) advocates for the use of "learning hooks" to help students better understand and grasp economic content. Hoyt (2003) suggests that educators diversify their teaching approach and utilize more active learning techniques, incorporate more relevant examples and integrate an interdisciplinary approach to teaching.

The use of art projects in the principles of economics classroom is a relatively new pedagogical tool that has recently received attention. Most of the attention has been focused on the use of literature in the economics classroom (Cotti and Johnson 2012; Hartley 2001; Watts 2002). In a recent project, Niamen, Furnagiev and Ward (2015), introduce <www.econjourney.com>. The website is a pilot program that allows students to create and write a story about a world that faces scarcity. Additionally, Vachris and Bohanon (2012) advocate for the use of literature in upper division labor economics courses. While Bransford, Brown and Cocking (2000) use memorable and interesting stories to help students' retention of the course material. The use of literature has progressed towards the use of Great Books of Western Civilization (Hartley 2001), historical novels (Cotti and Johnson 2012) and short stories (Ruder 2006) in economics classrooms. This transition from passive to active learning helps students retain more information versus traditional lecture-based models.

Other forms of art that have been suggested as good sources for active learning include the use of music (Holder et al 2015; McClough and Heinfeldt, J. 2012; Tinari and Khandke 2000), Paintings (Watts and Christopher, 2012). and poetry (Becker et al. 2006; Bohanon 2012; Ziliak 2009). Recently, there has been a movement towards a more visual form of art to engage economics students. These include, but are not limited to, the use of clips from cinema, movies, or film (Leet and Houser 2003; Mateer and Herman 2008; Sexton 2006), television shows (Acchiardo et al. 2014; Considine 2006; Hall 2005; Kuester et al. 2014; Luccasen et al. 2011; Mateer et al. 2011; Tierney et al. 2015), sports shows (Al-Bahrani and Patel 2015b)[6], animated cartoons (Luccasen et. al 2011), internet-based cartoons (Engel et al. 2014) and photography (Al-Bahrani et al. 2016).

Active learning techniques should help students reach this higher level of learning and students with a deeper understanding of content should have "the ability to think independently to determine necessary information, to provide persuasive substantiation of claims, to organize thoughts clearly, and to use precise, correct and effective language" (Santos and Lavin 2004). The use of writing in economics courses is a popular method to assess student learning,[7] especially deeper learning (Crowe and Youga 1986). Davis (2015) provides theoretical support for the use of creative arts in economics education while providing examples of the use of poetry in her classroom. Using cognitive and neuroscience literature, the author suggests that creative art projects could lead to a more memorable educational experience, engage more students, and increase economics literacy. However, like Buckles and Seigfried (2006) suggested, written

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[3] See Buckles, Hoyt, and Imazeki 2012; Deslauriers, Schelew, and Weiman 2011; Goffe and Kauper 2014; Miller and Rebelein 2012.

[4] Gorss et. al (2015) find that flipped classrooms in STEM majors help female and low-GPA students perform better.

[5] Please note that for all these activities students may have a relatively higher time cost compared to the instructor. In some cases, instructor's time cost can increase if they choose to be actively involved in either participating or assisting students with the activities.

[6] Provides a detailed literature review on the use of popular media in economic classrooms.

[7] See Brewer and Jozefowicz (2006), Chizmar and Ostrosky (1998), Greenlaw (2003), Dynan and Cate (2005) Dynan and Cate (2009), and Stowe (2010)

assessment can be time consuming to administer and also requires the grader to maintain fairness and have a great deal of judgment to ensure accuracy among the different types of answers that are submitted (Kates 2008).

The concern with the way art has been introduced in economics classrooms previously is that the projects mentioned are high stakes and high cost projects. This approach is often too costly for new instructors attempting to introduce art and creative thinking into their classrooms or for larger class sizes. Furthermore, the use of art projects can detract from covering economics content (Watts 1998). In this paper we provide instructors with low-cost active learning teaching and assessment projects. These assignments require students to create economics content by determining necessary information, organizing their thoughts clearly, and using economics language concisely. We believe that these assignments help differentiate the learning environment and lead to a more inclusive educational environment as suggested by Stowe (2010).

Examples of Active Learning Assignments

We provide several examples of assignments that can be used to break up the lecture or serve as active learning projects. These assignments rely heavily on artistic and creative expression of economic knowledge.

Learning Objectives

The purpose of these assignments is to improve literacy in the discipline by connecting economics with a variety of artistic avenues. By applying economics to events outside of a traditional classroom model, students apply the concepts, techniques, and methods of the discipline and improve their ability to connect economics with the world around them. Art of Econ assignments bring energy and excitement to the classroom by providing students with an opportunity to work with an activity of their own interest in order to gain a better understanding of the subject.

Context for Use

These activities can be used as either group or individual assignments, most can be completed either inside or outside of class and each can be assigned as homework or extra credit. In order to complete the assignments, students need access to a computer or mobile device. For assignments like Rockonomix, students will need access to a video recorder or camera. Proper instructions and resources should be shared well in advance, preferably at the beginning of the semester. We share handouts for each activity in our appendix section.

Teaching Notes

For instructors planning to adopt these assignments, it is helpful to provide clear instructions, assessment guidelines, and provide acceptable examples. For several of these activities, it is ideal to provide students with ample time over the semester to submit something that appropriately demonstrates their proficiency in understanding the economics content. Students can also be provided with checkpoints along the way to encourage them that they are on the right track and keep students focused on the learning outcomes related to the assigned work. Another suggestion is to allow the students to work in groups to enhance the learning process. This encourages students to improve their skills by learning from one another. Finally, our experience is that sharing several examples over the course of the semester as benchmarks enhances learning outcomes.[8]

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[8] Appendinx 2 includes links to examples for each assignment.

Assessment

To ensure students are meeting the stated learning objectives, different outcomes may be assessed on these activities. For each assignment, we share a rubric that provides more emphasis on assessment (See Appendix 1).

In the next section, we outline several suggested assignments for implementing this unique active learning strategy. The assignments are grouped into the following categories: music/media, visual arts, physical art, digital creation, and exploring the news/current events. These assignments also vary in their level of difficulty and costs for an individual instructor and their students. Some assignments are low cost to the instructor but might be relatively more costly to the student and vice versa. To better assist instructors, we identify the level of costs for both the instructor and student. We break these active learning assignment ideas into "low" and "medium" cost categories, for both students and instructors, since some activities are clearly less involved than others. For all assignments, instructions are attached in the appendix unless otherwise noted.

Music/Media

Rockonomix - The Rockonomix assignment challenges students to bring economic concepts to life by requiring them to choose a popular song, rewrite the lyrics and make it about economics, and record a new music video parody. The songwriting and video production process gives students the opportunity to analyze what they have learned inside the classroom and then requires them to actively construct a new teaching tool, extending their reach to the highest level of Bloom's Taxonomy. The Rockonomix assignment has been effectively implemented in face-to-face, hybrid and online formats covering both full-term and shortened summer semesters. Students must be comfortable with video and audio production or an alternative lyric writing assignment can be offered if a technology barrier exists. Holder et al. (2015) provides additional details, a sample rubric and guidelines for implementation.

ECON Behind the Music Media Analysis - The ECON Behind the Music Media Analysis assignment requires students to find economic concepts hidden within their favorite music by asking them to identify and analyze 3-5 economics terms that relate to their song of choice. A simplified assignment can assign a single song, such as Cost of Livin' by Ronnie Dunn, to the class as a whole for an in-depth class discussion. An extension on this assignment is to have students make a pop-up style video where the original song lyrics are retained and economics-themed facts and analysis are embedded within a new music video of the song (Hall, Lawson, and Mateer 2008; Holder, Mateer & O'Roark 2015)

Visual Arts

Infographonomics – Students who enjoy the visual arts can create infographics demonstrating their understanding of economics terms and concepts. These poster-sized visualizations of data can focus on economic data such as GDP or the CPI or show off student's knowledge of relevant course content. There are numerous web-based design sites available for making infographics, like Piktochart, or these revitalized posters can be made in PowerPoint by customizing dimensions within the program.

Video Scrapbooking – Scrapbooking has traditionally always been a means of preserving personal history or interests in an album using pictures, media, or artwork. As we are moving towards a more digital based society that is valued highly in the workforce, this idea of scrapbooking is conducted electronically. Keeping up to date with this information helps retain economics concepts better. Some of the best sources of economic information are newspapers and magazines, which are increasingly accessible online. Students will bridge the gap between economics and associated concepts through a video that streams clippings with concepts and narratives in a sequential order as the chapters are covered in class. Al-Bahrani, Dowell, and Patel (2016) provide a detailed explanation on the use of Video Scrapbooking.

St. Patrick's Day/Valentine's Day Card Poems - What better way to celebrate the seasons than with a holiday-themed poem utilizing terms and concepts from economics? Whether it is writing an economics-themed limerick or love sonnet, or even attempting an economics haiku, this assignment will inspire

students to draw on their language arts experience and explore the nuances of economics jargon. We suggest that students make holiday cards to display their poem, but poetry can also be submitted on its own.

Physical Art

Halloween Costumes, Pumpkin Carving, Easter Eggs - Holiday themed economics projects are not limited to literary assignments. Your hands-on learners will appreciate exploring their tactile understanding of economics by participating in an economics-themed Halloween costume contest, carving economics terms into pumpkins, or even decorating Easter eggs to illustrate their understanding of economics. These tactile projects allow students to make a concrete illustration of economics to help them remember concepts and terms on test day.

Dismal Art Project - You can let your students imagination soar by assigning the Dismal Art Project which allows for any type of economics-themed art, large or small, to be submitted along with an accompanying explanation of the work of art and the economic concepts being portrayed. This work of art can take the form of cartoons, drawings, paintings, infographics, fabric-based work such as an economics t-shirt or jersey, sculptures and more. The only limitation is your student's imagination and their ability to tie their work to an existing economics term or concept.

Digital Creation

Know-It-All Project - Giving students the freedom to pursue a topic of interest within the scope of economics is the key to the Know-it-All project. This research project allows your students become an expert in a subject of their own choosing, and the only limitation is that they need to explain the economics behind their topic to their peers in a unique and creative way. Whether they are exploring the economics behind a career in the NBA, why students cheat, how millennials spend their disposable income, or the economics of Walmart, students are taking ownership of their understanding of economics through the use of project-based learning.

Everyday ECON, ECON Selfies and ECON Memes - A picture is worth a thousand words, and an economics-themed picture can be worth a lot of points. Task your students with taking a photograph of economics in the world around them. They can illustrate an economics concept or term with a simple picture or with an economics-themed selfie or meme. For a more detailed explanation on the use of ECONSelfie see Al-Bahrani et al. (2015).

Exploring The News/Current Events

ECON Ads and ECON Today - Let students search out economics-themed stories in print or visual media by focusing on advertising (print or commercial) or interesting news items that are related to economics. The key to this assignment is to get students to think outside of the box and see the economics that permeates the world around them. Instructors should get students started on the right track by showing interesting, relevant examples of how economics permeates the real world.

Live-Tweet an Event - When an event of national interest occurs, such as the State of the Union address, the Olympics or the Grammy Awards, encourage students to engage with their class by "live-tweeting" an event. Define a class hashtag to keep the conversation going and monitor the conversation to direct it back to economics throughout the course of the event. Al-Bahrani and Patel (2015a) provide more information on how to use Twitter, "live-tweeting", and other social media platforms to engage students.

Instructor Tips

We provide a summary of all projects in Table 1. Instructors interested in integrating the arts into their class assessment can choose from this list based on time costs to the instructor, cost to students, whether they are interested in assessment that is in class or outside of class, and finally whether the assessment is individual or group based. We believe that incorporating these new teaching tools will help increase diversity of students by making economics relevant to more students. While these assignments might attract

new students, there is always the possibility that it might dissuade the traditional economics student. Therefore we recommend that these assignments be introduced as complements rather than substitutes to traditional teaching methods.

Table 1: Summary of Assignments, Costs, and Structure

Category	Art of Econ Assignment	Professor Cost	Student Cost	Completion Location[9]	Assignment Structure[10]
Music/Media	Rockonomix	Low/Med	Low/Med	Outside of Class	Group
	ECON Behind the Music Media Analysis	Low/Med	Low	Inside of Class	Individual or Group
Visual Arts	Infographonomics	Low	Low	Outside or Inside of Class	Individual or Group
	Video Scrapbooking	Low/Med	Low/Med	Outside of Class	Group
	St. Patrick's Day/Valentine's Day Card Poems	Low	Low	Outside or Inside of Class	Individual
Physical Art	Halloween Costumes, Pumpkins & Easter Eggs	Low	Low	Outside of Class	Individual
	Dismal Art Project	Low/Med	Low/Med	Outside or Inside of Class	Individual or Group
Digital Creation	Know-it-All Project	Low/Med	Low/Med	Outside of Class	Individual or Group
	Everyday ECON, ECONSelfies, ECON Memes	Low	Low	Outside of Class	Individual
Exploring the News/ Current Events	ECON Ads, ECON Today	Low	Low	Outside or Inside of Class	Individual
	Live-tweeting Events	Low/Med	Low/Med	Outside of Class	Individual

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[9] The recommended completion location is flexible. For example, if listed as Outside of Class, the professor can have face-to-face in-class workdays to keep students on pace and lower their costs of trying to find a meeting time. If listed as Inside of Class, it can be moved completely to an external assignment with well-written instructions and offering samples of A-level work.

[10] The recommended assignment structure of group vs. individual work is also flexible. Most assignments that are more difficult to grade or manage are listed as group as the structure to minimize costs to students and the professor. It can be adapted to an individual project in small classrooms or for courses where it makes up more of their grade.

Conclusion

As economics educators continue to adopt active learning strategies to enhance student learning, there has been an emphasis on active learning. However, incorporating active learning and differentiated teaching requires an investment of time. In this paper, we introduce and summarize several low-cost active learning assignments that provide educators with opportunities to incorporate the arts. These assignments are primarily aimed at capturing student's creativity and increase their ability to connect economics content to their own interests through a range of projects focused on music, art, popular media, and social media. We advocate for using these assignments in conjunction with the instructor's choice of assessment method to provide a more complete and encompassing differentiated assessment of student learning.

Faculty attempting to incorporate a differentiated teaching or assessment method can utilize the low-cost projects and rubrics provided. These projects are designed to create a more inclusive educational environment and attract a more diverse student body to the study of economics.

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Appendix 1: Rubric

Table 1: Adjustable Sample Rubric for all Projects

	1 point	2 points	3 points	4 points	5 points
Audio/ Video Quality	Unacceptable	Barely Acceptable	Average	Meets Expectations	Goes Beyond Expectations
Description of photo, article, submission, Caption, etc	Description of concept is generally inaccurate (contains a few major errors or omissions)	Description of concept is somewhat accurate (contains a major error or omission) Description is simply a textbook definition	Accurately describes the concept(s) with only minor errors or omissions	Accurately describes concept	Accurately describes concept Description suggests nuanced understanding of concept
Economic Concepts Covered in the Submission	Describes concept(s) in own words with some accuracy Concept(s) are not tied together in any way	Accurately describes concept(s) in own words Concept(s) are not tied together in any way	Accurately describes concept(s) in own words Concepts are tied together, but only occasionally and in a superficial way	Accurately describes concept(s) in own words Concepts are often tied together, but sometimes inaccurately Connects concepts in a cohesive theme, but some inaccurate connections	Connects concepts together in a cohesive theme for the entire song. Connections are mostly accurate
Creativity	Unacceptable	Barely Acceptable	Average	Meets Expectations	Goes Beyond Expectations

Appendix 2: Active Learning Assignments Guidelines

Music

Rockonomix

The task for the Rockonomix assignment is simple: students write new lyrics to a popular hit song, record their own economics-themed music video and post their musical masterpiece to YouTube. Holder et al (2015) provides full implementation details including access to a sample assignment sheet, rubric and peer evaluations along with the availability of national and state level contests and student examples.
Examples: https://www.youtube.com/playlist?list=PL6B745E4E47064D7E

ECON Behind the Music Media Analysis

Since economics is everywhere, it is not surprising that we find economic concepts in music. For this assignment, you need to analyze a song and identify the economics themes, key concepts, or basic

economic ideas that are contained within it. Working in small groups, each group needs to complete the following:

- At least two group meetings to discuss, edit or finalize the assignment: (1) for face-to-face classes you must utilize our scheduled in-class meetings (2) for online classes your meetings may take place either face-to-face or virtually.
- After groups are formed, reserve your choice by posting the title of the song, artist and year in your discussion post title and I will approve them to avoid excessive duplication of content. NOTE: you may reserve your choice by posting a "placeholder" post with the title in the discussion board, then go back and edit your original post before the assignment deadline. Example: Group 01 - Word Crimes by Weird Al Yankovic (2013).
- The body of the discussion post must include all of the following: group number, names of all your group members, course and section number, song (artist & year), brief interpretation of the basic message of the popular song choice (1-2 sentence maximum), a numbered list of the three economics concepts, definitions, principles or theories that are explored in your group's choice along with a brief definition in your own words and how it fits with the piece of media along with relevant supporting lyrics for each numbered concept.
- You must submit your completed peer evaluation by the assignment deadline.

Grading is based on the ability to follow instructions, the quality of your analysis, the uniqueness of the economics concepts your group found, and your explanation to the class. For classes that meet face-to-face, you will do an in-class presentation, which includes both speaking to the class as whole as well as making a visual aid (PowerPoint, Prezi, Glogster, movie, etc.). For classes that meet online you must attach a virtual presentation using any of the tools listed above or a narrated PowerPoint, SlideShare, movie, etc. - creativity matters! As always, spelling and grammar are important. You will lose points for the use of poor grammar, incorrect spelling, foul language, failure to complete the peer evaluation, or lack of participation in your group. NOTE: When referencing any explicit language, replace it with an asterisk or numbers string.

Each group always has the right to fire any group member who is not actively participating in their group. To complete this process, you must email the person who is being fired (copy me on the email) and state the reason for the firing and attach any appropriate documentation. The deadline for firing a group member is no later than one week prior to the due date.
Examples: https://www.pinterest.com/cubegrl/econ102-popecon/

Visual Arts

Infographonomics

Your task is to create an infographic that demonstrates economics terms or concepts. This poster-sized visualization can focus on any term or concept from our lecture or your course materials. These poster-sized masterpieces can be made in PowerPoint (customize dimensions) or by using an online resource like Piktochart.
Examples: https://www.pinterest.com/cubegrl/econ102-infographonomics/

Video Scrapbooking

Economics can be found everywhere. There is economics in newspapers, movies, literature, and most importantly in our daily lives. Keeping up to date with this information helps you retain understanding of economics concepts on test day. Some of the best sources of economic information are newspapers and magazines, many of which are accessible online. In these articles, you will find current information and opinions on nearly every topic and issue discussed in our textbook.

The goal of this project is to revive the concept of scrapbooking and use this method to make economic connections to the world around us. Scrapbooking has traditionally always been a means of preserving personal history or interests in an album using pictures, media or artwork. As we move towards a more digital based society that is highly valued in the workforce, the idea of scrapbooking will be conducted electronically.

Economics can be found everywhere. There is economics in newspapers, movies, literature, and most importantly in our daily lives. To provide yourself with a file of information on economic events, clip out and save portions of news articles and take pictures that you find interesting and informative. You can also find economics topics in movies, shows, and music. It may be useful to save them according to the chapter headings in the textbook or lectures.

When you are dealing with a particular chapter you will have clippings to supplement the information and opinions that arise in classroom work and discussion. When saving the clippings, write down a summary of how the piece is connected to the chapter theme or policy issue discussed in class in a minimum of 25 words (MAX 140 WORDS). Be sure to properly cite the source of the clipping. For example, if the clipping was found in an online newspaper, please provide the title of the article, the website retrieved from and the date.

Bring all clippings together and stream them like pictures. You should add a running narrative or, if the narrative is short enough, it can be present around the clipping. The streaming process continues with other clippings and narratives being introduced. The overall goal is to produce a video that streams the clippings with narratives in a sequential order. Thoroughness, creativity & colorfulness, organization and quality will be graded There is no length requirement. However, there must be a clipping for at least 8 different concepts/topics discussed in class. Between each clipping, there should be enough time for the viewers to read every clipping and its narrative. Finally, you should include some nice soothing background music.

Grading Criteria	Comments	Possible Points
Articles/Images/Photos	Are there at least 8 topics/concepts discussed?	5
Article/Image/Photo explanation	Are there 25-140 word explanations associated with each article, image, and/or photo? Did you explain how the article/image/photo illustrates the topic or did you just list concepts?	5
Economic content: clarity in explaining policy issues using an appropriate economic concept	Can I understand the connection between the images you have chosen and the economic concepts you are using to analyze the situation? Are you using economics correctly?	5
Creativity/originality	Fun to watch? Interesting overall? Are the graphics appealing and enhance the quality?	5
	Total:	**20**

Examples: https://www.youtube.com/playlist?list=PLyUSAxdqbBFRLVbKT5QbrRkrJNECSNtKx

St. Patrick's Day/Valentine's Day Card Poems

Get into the spirit of the season by creating a holiday card with an economics-themed piece of poetry. In this assignment, you will make a simple Valentine's Day or St. Patrick's Day card along with a poem that is designed around one or more economics terms or concepts. For the St. Patrick's Day card, write a limerick, which is a funny poem with five lines and a rhyming pattern of: a-a-b-b-a. For the Valentine's Day card, any short rhyming poem will work or you may experiment with more complex forms of poetry like a haiku.
Examples: https://www.pinterest.com/cubegrl/econ102-econ-holiday-cards/

Physical Art

Halloween Costumes:

Create an economics related Halloween costume and write a paragraph explaining your costume and how it is associated with economics. You should submit a photo of yourself wearing your costume in addition to your written paragraph by email or through the classroom's established social media accounts. Points will be awarded for creativity, thoughtfulness, and proper use of economics concepts. E
Examples: https://www.pinterest.com/cubegrl/econ102-halloween-costumes/   and https://www.pinterest.com/jjwooten/penn-state-economics-halloween-costume/

Easter Eggs:

Create an economics-themed Easter egg and write a paragraph explaining what it is and how it relates to economics. Marks will be awarded for creativity, thoughtfulness, and proper usage of economics concepts You should submit:

- A photo of your egg
- A photo of yourself with your egg
- Your paragraph of less than 200 words.

Examples: https://www.pinterest.com/jjwooten/easternomic-eggs/

Pumpkin Carving:

By submitting your image, you are allowing me to use the image of your pumpkin on my professional Pinterest page to show others how awesome this class is. Create an economics themed Halloween pumpkin and write a paragraph explaining what it is and how it relates to economics.
Examples: *https://www.pinterest.com/jjwooten/economics-pumpkin-carving/* *and* *https://www.pinterest.com/dirkmateer/econ-themed-halloween-pumpkins/*

Dismal Art Project

In the medium of your choice, create your own ORIGINAL work of art that expresses a central concept or concepts in economics. Bring me your finished product and post a photo of your work to Facebook, Instagram, Tumblr or Pinterest. This assignment is worth 0-3 points.

Any artistic medium is acceptable for this project, but it is strongly suggested that you consult with me about your ideas for the project prior to beginning work. All work contained within the project should be original to you, the artist. Note: collages of newspaper items will not be accepted. Your execution of the project will determine the total points you receive and you may work alone or in small groups of no more than 6 people. If you work in a group, a peer evaluation form (posted on the learning management system website) must be turned in with your project for each group member by the due date.

The theme of your project must be clearly about ECONOMICS. There must be a GENEROUS serving of economics contained within your project and you can use terminology or ideas from our textbook, class lectures or your prior knowledge about economics. You are free to use information from any chapter in our textbooks, even if we have not covered it in class.
Examples: https://www.pinterest.com/cubegrl/econ102-dismal-art-project/

Digital Creation

Know-It-All Project

If you want to challenge students to demonstrate their understanding of economics in a unique and innovative way, embrace the policy of "less is more" and give students the freedom to learn about a topic of their own choosing. Building upon Google's famous 20% time rule, which empowered employees to spend time on projects that were important to them, the only guidelines for this project are that: (1) the topic must relate to economics and (2) it must result in a very short non-traditional presentation (video, Prezi, or other production). Creativity and innovation are the key components and the goal is to illustrate economics in a distinctive and unusual way. Examples of student projects: Negative Externalities & You, Wally World Econ, and the Barter Survivalist.
Examples: https://www.pinterest.com/cubegrl/econ102-know-it-all-projects/

Everyday Econ/Real World Econ
This quick visual project is an easy way to introduce economics and works well as a first day or class ice-

breaker assignment. Students must take a photo of an economic concept found in the real world (or limit it to their immediate surroundings) and tweet it to the instructor using the hashtag: #everydayecon or #realworldecon. You earn ½ point for your tweet and an additional ½ point if the instructor retweets it, favorites it or shows it in class!
Examples: https://www.pinterest.com/cubegrl/econ102-everydayecon-%2B-realworldecon/

ECON Selfies

A self-portrait allows for self-expression and this opportunity allows you to connect yourself with the economics concepts we are learning in this course by taking a self-portrait style photograph, a 'selfie' that illustrates or contains some link to one of those economics concepts. To earn credit toward your final overall grade, you must submit your photo following these instructions. Photos should show you illustrating one economics concept and the one sentence (140 characters or less) caption should briefly explain the connection to the concept. By submitting a photo you release all copyright and recognize that it will be published on the social media resources for our class. Points will be awarded for accuracy, difficulty of concept and for creativity.

Submit by posting your ECONSelfie to Instagram with the tag #ECONSelfie or by using Twitter along with our class hashtag and #ECONSelfie. Alternatively, you may send your photo via email and the subject line of your email must include: your name and ECONSelfie. Within the body of your email you must include your 140 character limit caption and your photo. For a more detailed explanation and analysis on the use of ECONSelfie see Al-Bahrani et al. (2015).
Examples: https://www.pinterest.com/cubegrl/econ102-econselfie/

ECON Memes

One type of Internet meme, known as an image macro, includes a photo or image along with interesting or humorous text related to the picture. They often use popular icons like the Dos Equis spokesman (The Most Interesting Man in the World) or Yoda from Star Wars, and include witty observations that can be a thought-provoking form of "edutainment." In this assignment, your task is to create your own ORIGINAL economics or personal finance-themed meme using concepts, ideas, or terminology from your textbook, lecture notes, or class. Helpful meme creator sites are: quickmeme.com and imgflip.com. You can use established backgrounds found on meme creator sites as long as you add in your own original economics-themed text. Alternatively, you can use an image of your own along with your own original text.

Submit your completed project along with your name, concept(s) identification, and a 1-sentence description by the deadline via Twitter using #ECONmemes or email with the subject ECONmemes. Overuse of concepts/terms will not be approved (ex: 5 people submit memes about opportunity cost), so either submit EARLY or reference the Google Drive Slides FIRST to see what has been accepted before you submit. Your project is accepted when posted within our shared Google Drive Slides.
Examples: https://www.pinterest.com/cubegrl/econ102-econmemes/ and
http://economicsmemes.com/

Exploring The News/Current Events

ECON Ads

Economics is prevalent in the advertising world around us as marketing campaigns attempt to influence consumer choices. For this assignment, you must find a television or YouTube commercial (visual media) or an economics-themed print advertisement that contains at least one economic concept. In your submission, include the following: student name, identify the economic term or concept, and a link or copy of the advertisement (video clip or PDF file). Submit your assignment via Twitter using #ECONads or by email with ECONads and the student name as the subject line. *Note: Alternatively, ECONads can be assigned within your course's learning management system as a discussion-based assignment.*
Examples: https://www.pinterest.com/cubegrl/econ102-econads/

ECON Today

Economics permeates the news cycle in both print and visual media. For this assignment, you must find an interesting article or news clip about economics. The subject must be recent (within the last year), relevant to economics and thought-provoking. Since economics is found throughout everyday life, do not limit yourself to Wall Street Journal business articles, Federal Reserve reports or news clips about the stock market! Instead, be creative and utilize non-traditional resources! To submit, include: your name, identify the economic term/concept, a short paragraph about how it illustrates economics, and a permanent link or PDF/video file. You can submit it via Twitter using #ECONtoday or by email with your name and ECONtoday as the subject line.
Examples: https://www.pinterest.com/cubegrl/econ102-econtoday/

Live-Tweet an Event

The State of the Union Address (SOTU) is an important event that covers a lot of economic content. For this assignment, you must tweet a question or comment based on the SOTU address. Make sure to use the class hashtag so that your classmates and I can follow your posts. In addition to posting a question, you must respond to at least one of your classmates' posts. Al-Bahrani & Patel (2015) provide more information on how to use Twitter, "live-tweeting", and other social media platforms to engage students. Note, this idea can also be extended to presidential debates as shown in the example below.
Examples: https://twitter.com/search?vertical=default&q=%23debateecon

A Graphical Approach to Teaching the Capital Asset Pricing Model (CAPM) in Introductory Finance Courses

Brian R. Walkup[1]

Abstract

The relationship between risk and return is necessarily an important aspect of introductory finance courses. The Capital Asset Pricing Model (CAPM) is generally taught as the cornerstone model for measuring expected return given systematic risk as measured by beta, the market's risk-free rate, and the market risk premium. In this paper, I demonstrate a graphical method of building up to, and introducing, the concept of the CAPM. Students generally find this method to be intuitive and helpful in understanding the concepts of correlation, diversification, efficient frontier, risk vs return, and CAPM.

Keywords: CAPM, Capital Asset Pricing Model, graphical teaching approach

Introduction

The Capital Asset Pricing Model (CAPM) is an integral part of most (if not all) introductory finance courses. As a tool to calculate the expected return, the CAPM is relatively simple and straightforward with intuitive theoretical backing. As most faculty members emphasize the concept of risk vs return, CAPM shows a direct relationship between a stock's level of risk (as measured by beta risk) and its expected return. The CAPM equation is defined as:

$$E(R_i) = R_f + \beta_i[E(R_m) - R_f] \qquad (1)$$

where $E(R_i)$ represents the expected return on asset i, R_f represents the risk-free rate, β_i represents the beta of asset i, and $E(R_m)$ represents the expected return on the market portfolio. Alternatively, $E(R_m) - R_f$ can be replaced with the market risk premium given the definition of the market risk premium is the expected return on the market less the risk-free rate.

Textbooks generally present the Capital Asset Pricing Model by first familiarizing students with the concepts of risk and return and introducing the concept of the market risk premium. A definition of beta as a measure of risk is given and the relationships defined in CAPM are simply provided to the students alongside the equation. While there is nothing inherently wrong with this method, students often do not build solid understanding of the theoretical backing for why the CAPM exists. Consequently, the relationship between risk and return, which is the core of the CAPM, is not necessarily captured by the student. Instead, students often simply memorize the equation, what the terms mean, and how to "plug and chug" to an answer.

The method presented in this paper builds to a "derivation" of CAPM using tools students should all be familiar with from middle school mathematics courses. Building from an understanding of diversification through multiple risky assets, the development of an efficient frontier, and the addition of a risk-free asset, the method leads the student to develop the CAPM equation using the slope-intercept form of a line. As the student plays an active role in solving for the equation itself, there is a higher likelihood that they will not only remember the equation, but develop an understanding of the relationships inherent in the equation and the theory behind the model. From teaching this method over several years and numerous sections, as well as seeing other faculty adopt the method following discussions, this method has proven to be very successful.

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Background and Prior Literature

The Capital Asset Pricing Model (CAPM) originated from the works of Jack Treynor (Treynor, 1962), William Sharpe (Sharpe, 1964), John Lintner (Lintner, 1965a, b), and Jan Mossin (Mossin, 1966). The model is based on the idea that non-systematic risk should not affect asset prices given it can be diversified away. Therefore, the CAPM states that the expected returns on a portfolio (or an asset being added to a well-diversified portfolio) are driven only by the risk-free rate which can be achieved with no risk, the portfolio's (or asset's) sensitivity to market movements (it's systematic risk as measured by beta), and the expected return on the market above the risk-free rate.

While the CAPM is widely utilized, empirical testing has demonstrated that the relationship posed in the model does not necessarily hold in reality. For more information on the evidence on CAPM, see Fama and French (2004). Krieger, Fodor and Peterson (2008) discuss several of the shortcomings of the CAPM, show via survey evidence that most faculty still find it an important tool for core finance courses, and discuss the need for potential shortcomings to be covered with students. Though the CAPM is far from a robust estimate of expected return, it continues to be taught in intro finance courses due to its simplistic and intuitive nature.

The Method

Step 1: Look at the Efficient Frontier Given Two Risky Assets

It is important that the students have at least a working understanding of firm-specific (unique, diversifiable) risk, systematic (market, non-diversifiable) risk, correlation, and diversification to begin this step. If they have not yet been taught these topics, a short introduction to them should come prior to Step 1.

Given an understanding of these topics, the first step to this method of teaching CAPM is to demonstrate the efficient frontier for a two-asset portfolio. Remind the students that diversification comes from owning assets that are less than perfectly correlated, allowing unique risk to be diversified. Figure 1 is an example of a method to demonstrate the impact of non-unity correlation on portfolio returns in a two risky asset portfolio. The example is an easy way to demonstrate to the students the impact of correlation on diversification as the efficient frontier bows further back with decreases in correlation between the assets.

Figure 1. Two-Asset Portfolio Return and Standard Deviation
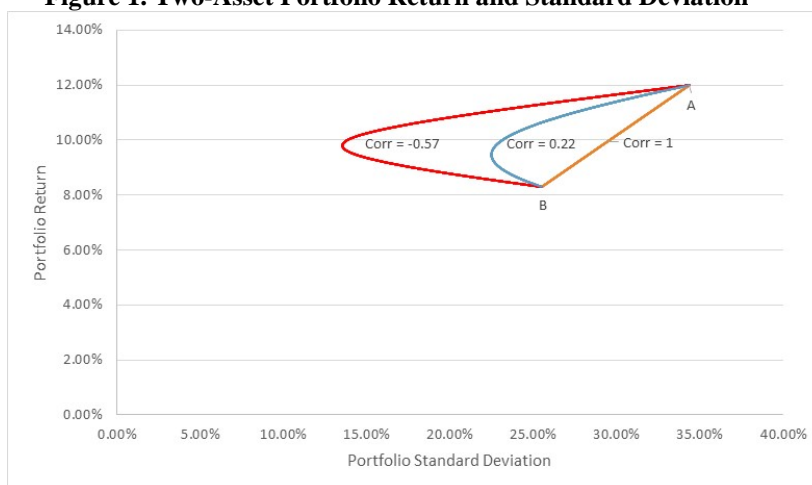
Discuss with the students which points on Figure 1 make sense from an investment standpoint and help them come to the realization that some points are stochastic dominant of other points by offering greater expected return with equal risk. This allows us to narrow the set of points on the curve from which a rational investor should choose from.

Step 2: Expand out to Multiple Risky Assets

The next step involves expanding the investor's opportunity set of assets beyond two risky assets. Introduce a third risky asset into the set of possible choices and demonstrate the new efficient frontier. By keeping the same two risky assets from Step 1 as members of the set and simply adding a third asset, it is possible to demonstrate the additional diversification of adding additional assets to the investor's portfolio. Figure 2 presents an example of this.

Figure 2. Three-Asset Portfolio and Standard Deviation
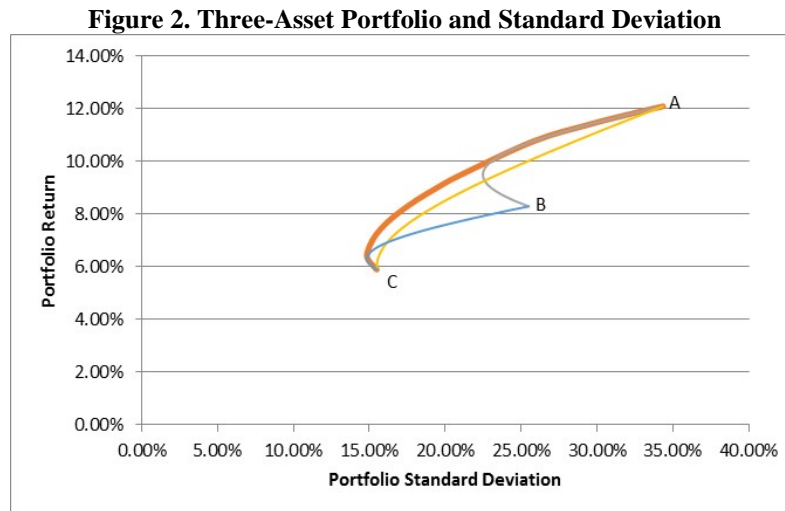
It is generally beneficial to go one step further by expanding the number of assets available once more. Figure 3 presents the efficient frontier given five risky assets. After showing this example to students, discuss the fact that there are a large number of risky assets available to investors, regardless of whether we consider our investment opportunity set as just U.S.-listed stocks, all stocks internationally, or even begin including other forms of risky assets (such as real estate, commodities, etc.).

Figure 3. Five-Asset Portfolio and Standard Deviation
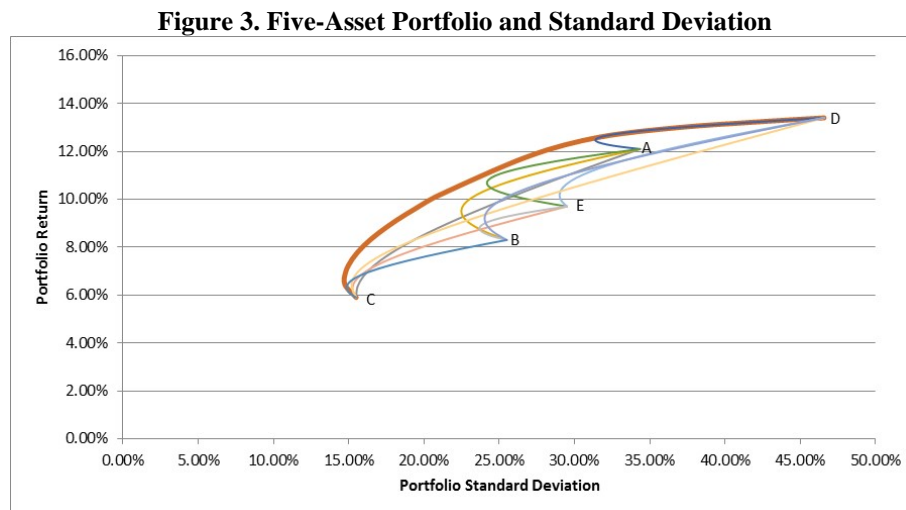
Step 3: Add in the Availability of a Risk-Free Asset

Now that students have a good idea of what the efficient frontier looks like in a world with numerous risky assets, a risk-free asset needs to be introduced. Open a dialogue with the students regarding whether or not a true risk-free asset exists, and if not, what would be a good approximation. After some open discussion,

steer the students toward an understanding of why the United States Treasury rate may make a good approximation.

Given the assumption that the U.S. Treasury rate can be used as an approximation for the risk-free asset, discuss the investor's potential portfolio combinations based on their investment opportunity set. Within the risk-return graph, which direction do we want to move? Help the students come to the realization that the aim is to move upwards and to the left. Given a level of risk, the goal is to increase the return. Given a level of return, the goal is to decrease the risk. Have them consider the risk-return graph given a wide variety of risky assets (as discussed in Step 2), but with the availability of a risk-free asset and working under the knowledge that the goal is to move up and to the left (this should look something like Figure 4). How do we achieve this goal?

Figure 4. Multiple Risky Assets with the Availability of a Risk-Free Asset
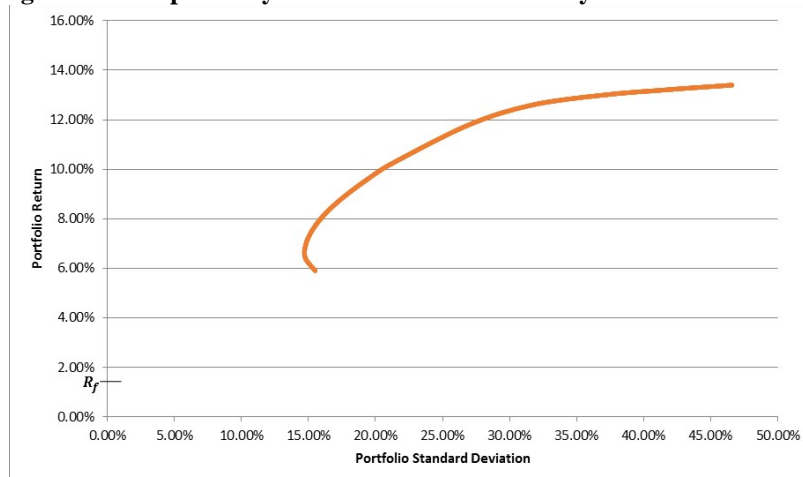
Begin drawing lines from the risk-free asset towards the efficient frontier created by the pool of risky assets (as shown in Figure 5). While lines A and B are feasible, they are Pareto suboptimal to line C which intersects the efficient frontier at only one point (the point of tangency). Lines D and E are Pareto optimal to line C, but how would we achieve these lines? Discuss with the class that there is not a feasible way to obtain lines D or E, therefore leaving line C as our optimal risk-return tradeoff at all given possible levels of risk.

Figure 5. Multiple Risky Assets with Risk-Free Asset – Potential Combinations
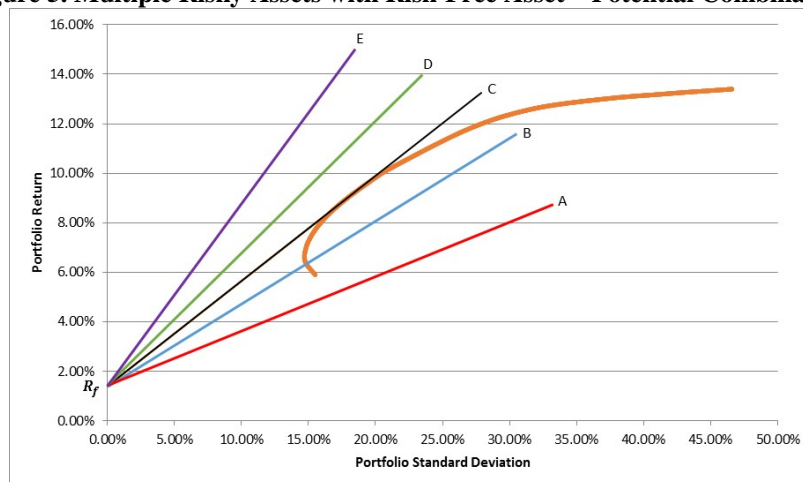
It is important that the students understand how any of the points on this line can be achieved. Discuss the fact that points between R_f and M can be achieved by creating a portfolio that holds some percentage between 0% and 100% in the R_f and the remainder in M. Have the students discuss whether points beyond M are achievable. After some discussion, guide them to the fact that borrowing at the R_f rate would allow greater

than 100% to be invested in *M*. Depending on the depth you want to cover, it is also valuable to discuss the idea that borrowing and lending rates are not always equal, and therefore the line may change slope beyond *M*.

This is also a good time to introduce students to the idea that the portfolio of risky assets falling tangent on the line from the R_f asset (portfolio *M*) is what is referred to as the market portfolio. Under the assumptions of the Capital Asset Pricing Model, all investors would hold only the market portfolio and the risk-free asset. The proportions that each investor would hold would be dictated by the level of risk aversion and the resulting utility indifference curves. Drawing indifference curves on top of Figure 5 (as can be seen in Figure 6) will help students recognize that a combination of *M* and R_f results in the greatest possible utility for any risk averse investor, therefore resulting in the market portfolio being the only risky asset held. Furthermore, it will help them recognize that different investors may hold different proportions of R_f and *M* depending on their utility functions.

Figure 6. Utility Indifference Curves
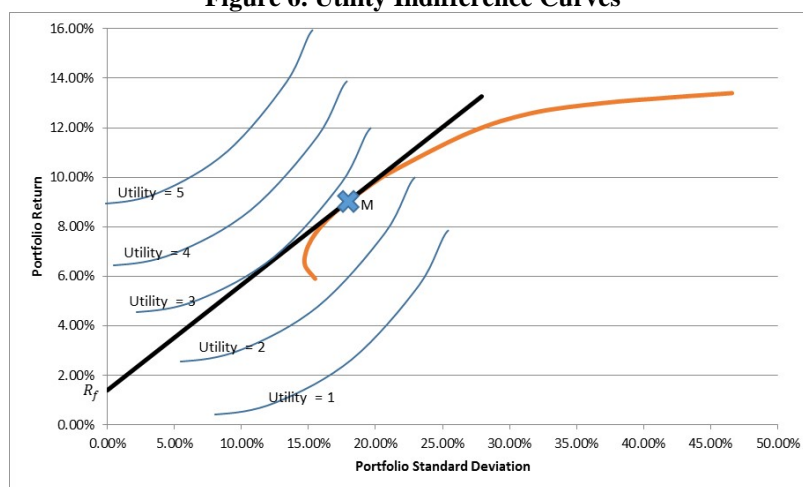
Step 4: Derive the Capital Asset Pricing Model Using Slope-Intercept Form

This step is where the main deviation from the typical introduction of the CAPM occurs. Using a concept generally learned by students during their middle school years, a very simple derivation (using the loosest of definitions of the term derivation) results in the students arriving at the CAPM equation. The concept being taken advantage of is the basic equation of a line taught via the slope-intercept form method. Ask the students if they recall the simple equation for a straight line. Generally at least one student will respond with the slope-intercept form (whether they use the specific term "slope-intercept" or not), which is generally written as:

$$y = mx + b \tag{2}$$

Within the slope-intercept form of a line, help the students recall that *y* and *x* are simply representative of the variables which make up the (*x*, *y*) coordinates on the graph, and are scaled thusly. Then remind them that the *b* term is simply the *y*-intercept, or the *y*-value when *x* is equal to zero. Finally, the *m* variable represents the slope of the line, the calculation of which is often taught as "rise over run." Rise over run refers to the change in the *y*-variable over the change in the *x*-variable between two points of the line.

Figure 7 draws attention back to the resulting figure from Step 3 (Figure 5), but focuses only on what was labeled Line C in Figure 5. Line C was determined to be the set of the most efficient portfolios that can be created from a combination of risky assets and a singular risk-free asset. The other transition made in Figure 7 is that the *x*-axis unit has been switched from standard deviation to beta. In an introductory level class, most faculty will likely find that this transition should not be focused on too heavily as it will likely confuse students. Instead, simply state that standard deviation and beta are both measures of risk. Therefore, we are simply transitioning our measure of risk from one form to another. Depending on the level you want to cover this transition, a short discussion of the fact that the CAPM assumes a diversified portfolio may be

worthwhile. Given this assumption, unique risk is diversified away, allowing us to transition from standard deviation to beta.

Figure 7. The Security Market Line
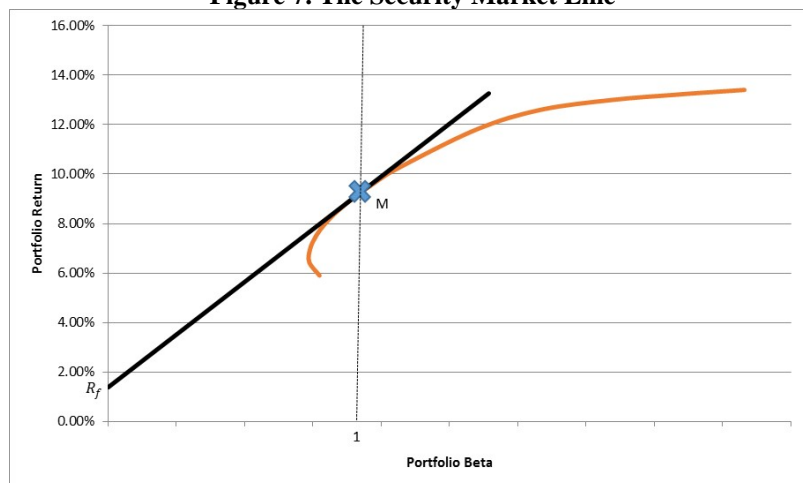
Having just discussed the concepts of slope-intercept form and rise over run, ask the students what we need to determine the equation of the line shown in Figure 7. The correct answer, which may need to be teased out if the students can't recognize it, is that we simply need the coordinates of the two points labeled R_f and M. Have the students tell you what the coordinates of these two points are, $(0, R_f)$ and $(1, R_M)$, respectively. The y-intercept should be relatively straight forward for the students. Be sure to emphasize the idea that this point makes intuitive sense; if one takes on an asset with no risk, they should expect the risk-free rate of return. However, the coordinates of point M may not appear as obvious to them at first. Emphasize the fact that, once again, this point makes intuitive sense. By definition, the beta risk of the market is 1. If an investor owns the market portfolio, they should anticipate the expected return of the market in return for the expected risk of the market.

Now that the students recognize the two points, have them assist in determining the slope-intercept equation of the line. This task breaks down into four unknowns which simply need to be identified and filled in. The left hand-side of Equation 2 is y, representing the underlying units that the y-axis is measuring. In this case, the y-axis is measuring expected return, therefore, $y = E(R)$. Likewise, x represents the underlying units of the x-axis. Therefore, $x = \beta$. The variable b in the slope-intercept form is replaced by the y-intercept. Therefore, $b = R_f$. Finally, m represents the slope of the line. As previously discussed, the slope of the line is calculated as rise over run. In other words, the change in y divided by the change in x, which can be formalized as:

$$m = \left(\frac{y_2 - y_1}{x_2 - x_1}\right) \tag{3}$$

Therefore, the slope of the line in Figure 7 can be calculated as:

$$m = \left(\frac{R_m - R_f}{1 - 0}\right) = R_m - R_f \tag{4}$$

Now that all four inputs to the slope-intercept form have been calculated, plugging them into Equation 2 reveals the equation of the line:

$$E(R_i) = R_f + B_i(R_m - R_f) \tag{5}$$

This is where the lightbulb moment can occur for students as you explain to them that they have just derived the Capital Asset Pricing Model. It must be explained that the subscript i is added to E(R) and β such that i can represent a specific asset or portfolio.

Step 5: Explain the Intuition behind the Capital Asset Pricing Model

Now that students have "derived" CAPM, it becomes significantly easier for them to understand the intuition behind the model. The intuition of CAPM can be simplified down to a very similar thought process as the slope-intercept method they just utilized. Remind them of the units of both the y-axis and the x-axis: expected return of asset i and beta of asset i, respectively. Start by having them think about what the y-

intercept implies. Essentially, it tells us that if we own an asset with a beta risk level of zero, we should expect the return of the risk-free asset. Intuitively, this makes sense and is hard to argue against.

Now, have them consider what happens as they make incremental changes along the line, moving right along the *x*-axis. Ask them to briefly explain what moving right along the *x*-axis means, in real-world terms. Help them arrive at the realization that it implies that we are taking on incrementally more risk, as measured by beta. What should this imply about the *y*-axis? Based on the concept of risk and return, we should receive additional expected return in response to this added risk. But, how much additional expected return?

To help answer this, have them focus on moving from the risk-free asset to the market portfolio. How much additional return does this move get them by definition? It gets the difference between the expected return of the market (R_M) and the risk-free rate (R_f). What amount of additional risk is required to obtain this shift in return? As the beta goes from 0 to 1, a one beta unit of risk is required. Therefore, to obtain $R_m - R_f$ in additional return, a one beta unit of risk is required. This is a good opportunity to define the market risk premium as this is what is being discussed. Inform the students that the market risk premium defines the premium an investor requires in expected return to absorb one beta unit of risk (the risk of the market as a whole).

If investing can be simplified to simply a tradeoff of additional risk to obtain additional return, then the above discussion determines the cost of additional return. Each unit of one market risk premium has a cost of one unit of beta risk. If we can obtain R_f of return at a cost of zero, then we have essentially created an intuitive version of CAPM. This can be demonstrated by first plugging in zero for beta. The resulting expected return is R_f. Now, plug one in for beta and demonstrate that the expected return is R_M. Therefore, an investor can increase his/her expected return by one unit of market risk premium by increasing his/her beta by one unit.

Discuss with the students what the expectation might be for taking one half unit of beta risk. Intuitively, if an investor takes only one half of the risk of the market, the expectation should be only one half of the market risk premium in return. Demonstrate this via the CAPM equation. Now, repeat this same exercise with the assumption of two units of beta risk. This should result in two units of market risk premium being added to the risk-free rate, which should again be demonstrated to be the case via CAPM.

How Students Respond

From past experience of using this methodology for introducing the Capital Asset Pricing Model, I have found that students find it very intuitive. In introductory level courses, many faculty members simply provide the CAPM equation and then follow by giving a brief (if any) explanation of the intuition behind the model. While the equation itself is simple enough to be easily memorized, students often miss out on gaining an understanding of why the CAPM is a simple and intuitive estimate of expected return. However, having students do the very simply and intuitive "derivation" via the slope-intercept form results in students gaining a strong grasp of why/how the equation works.

I have utilized this method for all sections of introductory undergraduate finance (required of all undergraduate business majors) as well as introductory graduate finance (required of all Masters of Business Administration students). In both courses I have found that my students gain a strong grasp of CAPM rather easily using this method. In fact, dare I say, they actually appear occasionally "excited" to feel that they were able to grasp the underlying theoretical reason why one of the equations in the course works. While helping students understand why the models I teach them in these courses is always something I strive for, I have yet to find a way to teach many of the concepts in a manner that students so easily grasp as I have this one.

Furthermore, a small number of faculty members that I have explained this method to have begun using it with similar success. They have described the method as simple and intuitive and have stated that their students appear to gain a better understanding (rather than just memorizing) of CAPM due to the method. I believe that faculty members that adopt this approach to "deriving" the Capital Asset Pricing Model and discussing intuitively why it works will find it is helpful in giving their students a better comprehension of the CAPM.

Conclusion

While the Capital Asset Pricing Model is one of the many topics taught in nearly every introductory finance course, the equation itself is often simply stated to the students. Textbooks and faculty members

presumably spend time attempting to explain to students the theoretical backing for the equation and why it works. However, from my experience and the experience of others I have spoken with, students generally end up simply memorizing the formula and many leave the course with little to no understanding of why the CAPM is a good estimate of expected returns. However, the method explained in this paper has been shown (in limited sample) to help students gain a better understanding of why the model makes sense intuitively, and therefore leads to a better comprehension of the model by students.

Using a simple tool that all students should previously be aware of (namely, the slope-intercept form of a line), students are led through an extremely simplistic derivation (using the term derivation very loosely). As students come up with the equation themselves, rather than having it simply told to them, they come to an "ah-ha" moment leading to an immediate sense of understanding of the equation. Rather than simply memorizing the formula, this method generally leads to a better ability to recall CAPM and appropriately utilize it throughout the rest of the course, and subsequent finance courses.

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Discounting at the Spread and Growing Annuities: A Note

Ken Johnston, John Hatem and Benjamin Woods[1]

Abstract

In this note, the relationship between the present value and future value of growing annuities using the "discounting at the spread" method is exhibited. In addition, the work of Hall (1996) is extended, demonstrating a calculator solution for the future value of a growing annuity.

Introduction

Geometric progressions are easily manipulated to arrive at the standard textbook formulae for the future and present value of annuities. Most introductory finance texts demonstrate the technique for turning the recursive formula for the future value of an annuity and the present value of an annuity into their respective closed form solutions.

Eck and Ungerer (1987, pp. 15) and Eck (1996, pp. 70-71) demonstrate that substituting in $[(1+i) / (1+g)] – 1$ for i inthe PV of an annuity formula provides a solution for the present value of a growing annuity. (Note i here is the nominal rate of interest and g is the growth rate of the annuity, hence this would be the real rate of interest in the Fisher equation, if g was the expected rate of inflation). They called this "*the spread between the growth and discount rates*" or "*discounting at the spread*".[2]

Eck (1996) and Hall (1996) in consecutive papers illustrate the present value of growing annuities. Both authors use the "*discounting at the spread*" method to simplify their demonstrations. Eck references the use of a computer program while Hall references a calculator solution. Neither author presents the relationship between the present value and future value of growing annuities using this method, which is demonstrated in this paper. In addition the work of Hall (1996) is extended demonstrating a calculator solution for the future value of a growing annuity.

Future value of a growing annuity

As mentioned previously, Taylor (1986) derived the closed form solution for the future value of a growing annuity. As with the present value formula, the final form is easier to implement by using the "*discounting at the spread*" method and a financial calculator. By substituting in $(1+k) / (1+g) - 1$ for i in the financial calculator we are able to arrive at a solution for both the future value of agrowing ordinary annuity and a growing annuity due while bypassing the complex closed form solutions of Taylor (1986).

The relationship between the present and future value interest factors of the annuity formulae drives this methodology. The present value interest factor of an ordinary annuity, PVIF, is represented by:

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[2]For the remainder of the paper, we will use k, for the nominal rate of interest, when substituting for i in keeping with Taylor (1986).

$$\left[\frac{1-\dfrac{1}{(1+k)^{n}}}{k}\right] which\ can\ be\ written\ as \left[\frac{(1+k)^{n}-1}{k(1+k)^{n}}\right]$$

Since the future value interest factor of an ordinary annuity, FVIF, is $\left[\dfrac{(1+k)^{n}-1}{k}\right]$ multiplying the PVIF by $(1+k)^{n}$ gives the future value interest factor, or FVIF equals the PVIF time $(1+k)^{n}$. Hence, by discounting at the spread, i.e. substituting $[(1+k)/(1+g)]-1$ for i, the future value of a growing annuity can be found by multiplying the PVIF of a growing annuity (PVIF$_{ga}$) by $(1+k)^{n}$.

A second method to calculate the future value of a growing annuity is by multiplying the payment by $(1+g)^{n-1}$ and use the FVIF for a growing annuity (FVIF$_{ga}$). To clarify this point, a comparison of Taylor's formula for the future value of a growing annuity and discounting at thespread is conducted.Taylor 's (1986, p. 17) closed form solution for the future value of a growing annuity is:

$$FV_{ga_{(ord)}} = pmt_1\left[\frac{\left(1+k/m\right)^{nm}-\left(1+g/m\right)^{nm}}{\left(k/m-g/m\right)}\right] where\ m\ is\ the\ number\ of\ compounding\ periods\ per\ year$$

To simplify the comparison annual compounding is assumed , therefore the formula becomes:

$$FV_{ga_{(ord)}} = pmt_1\left[\frac{(1+k)^{n}-\left(1+g\right)^{n}}{\left(k-g\right)}\right] where\ pmt_1\ is\ an\ end\ of\ period\ amount$$

Starting with the FVIF of an ordinary annuity formula, $\left[\dfrac{(1+i)^{n}-1}{i}\right]$, then substituting

$[(1+k)/(1+g)-1]$ for I yields the following:

$$\left[\frac{\left(1+\left[\dfrac{1+k}{1+g}-1\right]\right)^{n}-1}{\left(\dfrac{1+k}{1+g}-1\right)}\right] this\ leads\ to\quad \frac{\left[\dfrac{(1+k)}{(1+g)}\right]^{n}-1}{\dfrac{(1+k)-(1+g)}{(1+g)}} which\ gives\quad \left[\frac{\dfrac{(1+k)^{n}-(1+g)^{n}}{(1+g)^{n}}}{\dfrac{(k-g)}{(1+g)}}\right]$$

Rearranging terms:

$$\left[\frac{\left[(1+k)^{n}-(1+g)^{n}\right](1+g)}{(1+g)^{n}(k-g)}\right] and\ multiplying\ by\ (1+g)^{n-1} results\ in \left[\frac{\left[(1+k)^{n}-(1+g)^{n}\right]}{(k-g)}\right]$$

The reason for multiplying by $(1+g)^{n-1}$ instead of $(1+g)^n$ is because Taylor's formula uses the end of period payment, pmt_1. For example, assuming the payment at time zero, pmt_0, is \$100 and the growth rate is 5% then the end of period payment, pmt_1, is \$105. However, discounting at the spread starts with the payment at time zero, $pmt_0 = pmt_1/(1+g)$. A numerical example of this method follows:

Start with \$100 today and assume that it grows at 5% a year. The cashflow in year one would be \$105, in year two, \$110.25, and in year three, \$115.76. Assuming these are the three growing annuity payments, compounding them forward at a rate of 6% a year yields future value amounts at the end of the third period of \$117.98, \$116.87, and \$115.76 respectively. This totals to a future value of \$350.61. Using the $(1+k)/(1+g) - 1$ substitution noted above $((1.06/1.05 - 1))$, yields 0.009524. In a calculator we would have PMT = $105*(1.05)^2 = \$115.76$; N = 3; PV = 0; I=.9524; and then compute the FV. The answer is \$350.61. Note that the PMT is the value of the first payment, \$105 compounded over the number of periods that we are calculating the growing annuity minus 1(or the value of the \$100, the first payment discounted one period,compounded over the number of periodsthat we are calculating the growing annuity). In simple terms the PMT is the last cash flow of the growing annuity.

In order to calculate the future value of a <u>growing annuity due</u> we simply put the calculator on beginning instead of end. (The three actual future value amounts at the end of the third period in this case would be \$119.10, \$117.98 and \$116.87 respectively rather than the ones above.)

Lastly, the equivalence of multiplying $FVIF_{ga}$ by $(1+g)^{n-1}$ and multiplying the $PVIF_{ga}$ by $(1+k)^n$ is demonstrated.

We start with the PVIF and substitute in $(1+k)/(1+g)-1$ for i:

$$\left[\frac{(1+i)^n-1}{i(1+i)^n}\right] \ and \ then \ \frac{\left[1+\frac{(1+k)}{(1+g)}-1\right]^n-1}{\left[\frac{(1+k)}{(1+g)}-1\right]\left[1+\frac{(1+k)}{(1+g)}-1\right]^n}$$

Rearranging the terms

$$\frac{\left[\frac{(1+k)}{(1+g)}\right]^n-1}{\left[\frac{(1+k)}{(1+g)}-1\right]\left[\frac{(1+k)}{(1+g)}\right]^n} \ gives \ \frac{\left[\frac{(1+k)^n-(1+g)^n}{(1+g)^n}\right]}{\left[\frac{(1+k)-(1+g)}{(1+g)}\right]\left[\frac{(1+k)^n}{(1+g)^n}\right]}$$

Simplifying and multiplying through

$$\frac{(1+k)^n-(1+g)^n}{(1+g)^n} * \frac{(1+g)^n(1+g)}{(k-g)(1+k)^n}$$

Crossing out terms, dividing by $(1+g)$ and multiplying by $(1+k)^n$ gives:[3]

$$\left[\frac{\left[(1+k)^n-(1+g)^n\right]}{(k-g)}\right]$$

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[3]To arrive at the $PVIF_{ga}$ you need to divide by $(1+g)$ since, as discussed earlier, discounting at the spread starts with payment at time zero, $pmt_0 = pmt_1/(1+g)$

Which is the term found previously by multiplying the $FVIF_{ga}$ by $(1+g)^{n-1}$.

A numerical example using the previous information from the first example is shown. The three cash flows discounted to the present value are \$99.06, \$99.12, and \$97.20. This gives a total present value of \$294.38. To calculate the PVGAN on the calculator you would type in: PMT = 100; N = 3; FV = 0; I=.9524; and then compute the PV. The answer is \$294.38. Multiplying this number by $(1.06)^3$ gives you \$350.61 the future value of the growing annuity. Note that the PMT is the value of the first payment \$105 discounted back one period, \$105/1.05 =100.

Conclusion

In this paper, the relationship between the present value and future value of growing annuities using the "discounting at the spread" method is exhibited.We demonstrate the ease of using the "*discounting at the spread*" method to arrive at a financial calculator solution for the future value of both an ordinary growing annuity and a growing annuity due. This demonstration is a variant of Hall's (1996) paper which illustrated the analogous present value calculations.

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Dollars per Pound or Pounds per Dollar? Using the Kumon Method to Increase Student Understanding of Topics in International Finance

Valeria Martinez[1]

Abstract

In this work I use the Kumon method in International Finance to help students become proficient on basic course topics. This lets them achieve a stronger foundation and allows them to focus on more complex course topics without struggling with the basics. Students improve their skills on the basic course topics using the Kumon-type worksheets. The majority agreed that the worksheets helped their overall understanding of International Finance.

Introduction

In the time I've been teaching international finance I've realized that many of my students' questions on more complex topics were really about currency conversions or reading currency quotes. Based on this experience, I looked for a way to help my students increase their understanding and proficiency on the basic topics of the course so they could be better equipped to tackle more challenging themes. In this endeavor I decided to try the Kumon method.

Previous research developed to help students understand topics in international finance includes: Butler and Kwok (1994), Arnold and Buchanan (2004), Brozik and Zapalska (2004), Marshall (2004), Holowczack (2007), Sandler (2008), Faulk, Smolira, and Yoo (2010), Flanegin, Zapalska, Rudd, and Litzinger (2010), and Chou and Liu (2013) among others.

Many of these studies are aimed at explaining the fundamental theories of international finance. Arnold and Buchanan (2004) build an excel exercise to help students understand interest rate parity and deviations from it. Marshall (2004) develops a simulation on triangular and interest rate arbitrage. In a similar vein, Holowczack (2007) uses real time data to explore triangular arbitrage, covered interest arbitrage, and forward rate quote spread models. Faulk et al. (2010) also use simulations to help students grasp various theories in international finance such as- purchasing power parity, the international Fisher effect, interest rate parity, the expectations theory of forward rates, the return components of international investing, and how they are applied in the real world.

Other studies focus on helping students understand foreign currency market mechanics. Butler and Kwok (1994) use a market simulation game to help students understand foreign exchange market dynamics and the impact of current events on foreign exchange rates. Brozik and Zapalska (2004) use simulations to explain hedging of foreign currencies. Sandler (2008) creates a project in which students use regression analysis to forecast foreign exchange rates. Flanegin et al. (2010) create a mock auction market in which students trade currencies. Chou and Liu (2013) analyze whether using trading simulations helps students better understand the foreign exchange market.

Nonetheless, to be able to understand the functioning of currency markets and the underlying theories in international finance a first step is to learn how to read and convert currency quotes accurately and quickly- a hurdle for many students. The current work deals with these issues. To my knowledge, this work is the first attempt to help students understand the basic fundamentals of international finance- reading and converting exchange rate quotes- using the Kumon method.

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The Kumon Method

The Kumon method was created by Toru Kumon in 1954. Mr. Kumon was a math teacher who wanted to improve his son's math skills and thus created the Kumon method. This method seeks to make computational skills automatic, leaving students with time to work on more complicated topics. Bloom (1968, 1974) argued that sufficient time, appropriate instruction, and corrective feedback will enable 95% of the students to learn what only 20% were thought to be capable of. The three elements that Bloom mentions are essential components of Kumon.

For over 50 years, the Kumon method has been taught at after school learning centers around the world as a complement to the regular school curriculum. More than 50 million students worldwide have attended Kumon centers.[2] However, this method has also been used in schools to improve the performance of at-risk students (Oakley et al., 1993). In addition, the Kumon method has been used to improve student understanding of mathematics at the junior college level (Hazel and Puay San, 2007). More recently, Eguchi (2010) reported using the Kumon method to provide remedial mathematics courses to help first-year students at Niigata Sangyo University in Japan transition to the high-level study of economics.

The Kumon method is based on dividing a learning goal or topic into small sequential steps. A student is then guided through these steps via the sequential worksheets s/he must complete. Students work through a series of sequential worksheets that allow for lots of repetition and practice of the topic at hand. Speed and accuracy are important factors in working through these worksheets. Students are required to correct their errors allowing them to develop self analytical skills.

The typical after-school Kumon program works as follows:[3]

1. Kumon is to be practiced everyday for approximately 15-30 minutes.
2. Students attend Kumon centers 2-3 times per week.
3. They present their instructor with their homework and complete that day's worksheets at the center.
4. The instructor corrects the homework and gives it back to the student to work on until he can obtain a perfect score on those sheets.
5. Students leave the center with homework assignments for the next few days.

As mentioned above, speed and accuracy are important factors in working through these worksheets. This is why at the top of each worksheet we note beginning and end times of the task. We would expect to see that as students progress through the worksheets they take less time to do so. Another important aspect of Kumon is students' self correction of errors on their worksheets, which is an opportunity for self-teaching. As they progress through the worksheets, students become more confident in their ability to solve the tasks at hand. The instructor's job is to offer guidance through praise, hints, and individualized feedback on the students' work.

Applying the Kumon Method of Learning in International Finance

To create the worksheets I use for my course I followed the Kumon principle of breaking down the information into small pieces. The first step in this method is to write down the objective you wish to reach and then create the progression of tasks that will lead to that objective. The objective of the worksheets is for students to become proficient at reading and estimating currency quotes and currency conversions. Figure 1 maps out the worksheet sequence.

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[2] "Kumon History," http://www.kumon.com/AboutKumon/KumonHistory.aspx#1

[3] For a detailed description of the Kumon Method see: Ukai, Nancy. 1994. "The Kumon Approach to Teaching and Learning." *Journal of Japanese Studies 20*: 87-113.

Figure 1: Worksheet Map

Quote Identification
Indentifying Direct and Indirect quotes (worksheets 1-2)

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Estimating Direct/indirect Quotes
Reading and Estimating Direct and Indirect Quotes (worksheets 3-4)
Reading and Estimating quotes as they appear in popular finance textbooks and financial publications**(worksheets 5-6)
Quiz on Reading and Estimating Quotes for worksheets 1-6

↓

Estimating Cross Rates
Identifying cross currency quotes (worksheets 7-8)
Estimating cross currencies (worksheets 9-10)
Quiz on estimating cross currencies for worksheets 7-10

↓

Currency Conversions
Converting from home to foreign currencies and vice versa (worksheet 11)
Converting from foreign to foreign currency (worksheet 12)
Quiz on currency conversions for worksheets 11-12

** Popular finance textbooks include: Madura, J., 2010, International Financial Management, 10th Edition, South-Western Publishers, and Eun, C. and Resnick, B. 2011. International Financial Management, 6th Edition , McGraw-Hill Publishers. Examples of quotes from financial publications are presented as in the Wall Street Journal and Bloomberg.com

Just like the original Kumon method, the four types of worksheets outlined in the map are sequential. Nonetheless, the worksheets within each of the four categories may be of similar difficulty or parallel, stressing the notion that repetition leads to proficiency. For example, when learning how to estimate direct and indirect quotes, I've created worksheets which show quotes from textbooks and quotes from commonly read financial publications. Both types of worksheets have the same degree of difficulty and both help students master estimating direct and indirect quotes. They are simply different ways of presenting the questions students must solve. For those that are not familiar with the Kumon method, it is important to stress that exercises in these worksheets must be open ended questions and not multiple choice questions. Students must work through the full exercises without the option to guess the answer.

I implemented the Kumon method in class for approximately 5 weeks of a 15 week course. When a new concept on quotes or conversion was introduced I worked a few examples with my students and then allocated time, depending on the difficultly of the worksheet, for them to finish it. In addition, students were given worksheets with the same topic that was covered in class to work on at home.

The suggested time for the International Finance quote worksheet sequence is as follows:

1. Quote identification -5 minutes
2. Estimating direct/indirect quotes – 5-10 minutes
3. Estimating cross rates – 10-15 minutes
4. Currency Conversions 15-20 minutes

Table 1 shows a suggested sequence for the worksheets during these weeks. While students were becoming proficient at reading and estimating quotes, we covered foundation course topics. Once students became adept at reading, estimating, and converting currencies we moved on to the more challenging course topics which rely heavily on this foundation.

One of the biggest challenges of implementing the Kumon method is time management both inside and outside of the classroom. In class quizzes, exercises, and their discussion can take up to 25 minutes of class time each session. If the method is applied for approximately 5 weeks, twice per week, this means that at least 3 full 75-minute classes will be dedicated to this endeavor during the semester. In addition there is the issue of grading the worksheets and providing students with individualized feedback.

To aid in self correction and guided feedback, each class I show answers to homework to be turned in that day and ask students to correct their own homework before turning in. At this time we address any questions that arise on the homework. We use this same method of self-correction for the worksheets we work on in class. This helps keep students on track for the upcoming worksheets and also reduces the instructor's grading task outside of class.

Table 1:Worksheet Implementation

Class	Class worksheets	Assigned homework for next class
1	Worksheet #1	Worksheet #2
2	Worksheet # 3	Worksheet #4
3	Worksheet #5	Worksheet #6
4	Quiz on worksheets 1-6	
5	Worksheet #7	Worksheet #8
6	Worksheets #9	Worksheet #10
7	Quiz on worksheets 7-10	
8	Worksheet #11	Worksheet #12
9	Quiz on worksheets #11-12	

The instructor plays a supportive but central role in its implementation. Ukai (1994) notes that teachers' belief and motivation in the Kumon program are central to its success. It is also very important to get students on board with the worksheets. As the course instructor, you should clearly explain the purpose of the worksheets and how working on them will help them master the course foundations.

Kumon material is continually being enhanced updated and changed based on students' needs and instructor's observations. Thus I urge you to use this as a guide for your own course but modify as you see fit. All students and all instructors are not alike. Keep it fun and interesting for your class and yourself.

Results

The Kumon method was applied to two undergraduate International Finance classes of 21 and 28 students, respectively. International Finance is an elective business course. More than 95% of the students in the class were seniors and over 88% were finance majors. The class met twice a week for 1 hour and 15 minutes.

The students were directly tested on their achieved learning in reading and converting currencies. Two of the three course tests included one open-ended complex problem on currency conversions. On the first test students solved a cross currency construction problem. On the second test they worked on converting multiple amounts of money in various currencies to a common currency. Students scored on average 80% and 79% (n= 49) respectively on each of these problems.

In a previous semester where students did not use the Kumon type worksheets, when asked to construct cross rates, the average score on this test problem was 72% (n=46). This shows that when using the Kumon worksheets on average, students where better able to construct cross rates. And although this difference in score is not statistically significant, we cannot negate the increase in their scores. In addition, it is important to point out that when using Kumon worksheets students use currency notation much more consistently in their answers to the problem. When they do not use Kumon worksheets in class they do not use the notation but simply concentrate on the numbers in the problem without writing down what each number represents and what specific cross exchange rate they are looking for. Based on this information, it seems students who use the worksheets have a better understanding of the topic and a more consistent way of solving these problems.

At the end of the course students were surveyed on their perceived usefulness of the Kumon worksheets in International Finance. Table 2 shows the results of this survey. In general, the survey results show strong support for the worksheets. I find that 88% percent of students surveyed (n=43) agreed/strongly agreed the worksheets improved their overall understanding of International Finance. 95% of students agreed or strongly agreed the worksheets helped them become more proficient at solving foreign currency problems. At the end of the survey, students were asked to provide comments on the worksheets. Taken as a whole, student comments were very positive. Below I provide a sample of these:

- "I feel these worksheets were extremely helpful in order to understand more in depth problems. These worksheets allow the smooth conversion of currencies to be done rather than me having to think and take extra time to solve the problem"
- "I thought they were very helpful and made what could be a confusing topic simple and easy to understand."
- "The worksheets helped me to learn conversion so that the rest of the work was more comfortable to do."
- "They were very useful since a lot of practice makes you understand the theory well."
- "At first seemed bothersome but then effective."
- "The repetitive nature of the foreign currency worksheets aided my learning tremendously…"

Table 2: International Finance: Foreign Currency Worksheets Survey

Please rate the following statement about the use of the in-class foreign currency worksheets. Check off the response that best corresponds to your level of agreement with each statements (a through g).

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
	(5)	(4)	(3)	(2)	(1)
a. The worksheets helped me learn the **difference between** direct and indirect quotes.	76.74%	20.93%	2.33%	0%	0%
b. The worksheets helped me learn **how to convert direct to indirect quotes** and vice versa.	74.42%	25.58%	0%	0%	0%
c. The worksheets helped me understand **how to read** cross exchange rates.	55.81%	30.23%	13.95%	0%	0%
d. The worksheets helped me learn **how to estimate** cross exchange rates.	58.14%	30.23%	11.63%	0%	0%
e. The worksheets helped me **learn how to convert amounts of money** from one currency to another.	76.74%	20.93%	2.33%	0%	0%
f. Overall the worksheets helped me to become **more proficient at solving** foreign currency problems.	62.79%	32.56%	4.65%	0%	0%
g. The worksheets helped improve my overall **understanding of International Finance**.	46.51%	41.86%	11.63%	0%	0%

Conclusion

The present work has shown how the Kumon method can be applied to help increase student understanding of basic concepts in a college-level course. Using this method in International Finance is intended to help students achieve mastery in quote interpretation and estimation as well as currency conversion so they can focus on the more complex themes of the course without having to struggle with the basics. The present work is an example of how the Kumon method can be successfully applied to help students understand course material at the college level in different areas of study.

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Appendix: Sample Worksheets

Reading and Estimating FX Quote Worksheet#1

Name_____ **Date** _____ **Grade**_____ **Time** ____to_____

Based on currency notation learned in class, in the spaces below write whether it is a **direct** or an **indirect** quote.

Example: Swedish Krona (SEK/USD): 7.0199   **indirect**

Denmark Krone (DKK/USD): 5.8736

Swiss Frank (CHF/USD) : 0.9489

Euro (USD/EUR): 1.2655

Mexican Peso (MXN/USD): 13.7690

Brazilian Real (BRL/USD): 2.0340

Polish Zloty ((PLN/USD): 3.3497

U.K. Pounds (USD/GBP): 1.5681

Malaysian Ringitt (MYR/USD): 3.1556

Indian Rupee (INR/USD): 56.15

Argentine Peso (ARS/USD): 4.430

Reading and Estimating FX Quotes Worksheet #5

Name_____ Date _____ Grade_____ Time ____to_____

    Use the information on the following currencies to answer the questions below. Round your answers to **4 decimals**.

Australian Dollar (A$): $.7671	.8 Euros for one U.S. Dollar
New Zealand Dollar (NZ$) in $: $0.8625	13.761 Mexican Pesos for a U.S. Dollar
British Pounds (£): $1.9382	1.0539 U.S. Dollars per Swiss Franc
Polish Zloty (zł): $0.2985	$0.9792 per Canadian Dollar
Japanese Yen (¥): $0.0050	8.2022 South African Rand per U.S. Dollar

Example:

Find the <u>indirect quote</u> for the South African Rand: 8.2022 (ZAR/USD)

1. Find the direct quote for the Japanese Yen.

2. Find the indirect quote for the Euro.

3. Find the indirect quote for the Canadian Dollar.

4. Find the direct quote for the Swiss Franc.

5. Find the indirect quote for the New Zealand Dollar.

6. Find the direct quote for South African Rand.

7. Find the indirect quote for the Mexican Peso.

8. Find the indirect quote for the Polish Zloty.

9. Find the indirect quote for the Australian Dollar.

10. Find the direct quote for the British Pound.

Using the FRED Excel-Based Application to Improve Learning Outcomes in Economic Courses: From Student to Practitioner

Darshak Patel[1] and James W. Saunoris[2][3]

ABSTRACT

This paper describes active learning strategies utilizing the recently developed FRED Excel-based application to bridge the gap between economic theory and empirics. The FRED Excel-based application permits students to collect, manipulate, and plot macroeconomic data within Excel. We propose using this application as a tool for students to test economic theories using real world data. We maintain that this learning-by-doing strategy is an effective way to improve learning outcomes in undergraduate economic classes. To illustrate the ease and benefits of using the FRED Excel-based application to support standard economic theories, we provide several sample assignments specific to an intermediate macroeconomics class.

Introduction

Economic education is revitalized when instructors adopt innovative teaching methods and move away from the traditional mode of "chalk and talk" and PowerPoint lectures (Watts and Becker 2008; Maier, McGoldrick, and Simkins 2012). The problem with traditional strategies is the limited one-way interaction from lecturer to students. Furthermore, this teaching practice does not adequately develop applied and critical thinking skills among students (Simkins 1999). Thus, instructor's choice of pedagogy clearly plays a significant role in developing and fostering student's understanding of economic theories. Arguably, learning is enhanced when students become active participants—i.e. by adopting techniques that promote two-way interaction between instructor and students. By using active learning as a pedagogical tool, students benefit by having a deeper understanding of economic concepts (Salemi 2002).

Some pedagogy has implemented the use of real-world economic events to spark student interest on economic related concepts (Aguilar and Soques 2013). Ultimately, as students gain interest in the subject, the more likely they are to think like an economist (Siegfried et al. 1991). The prevalence of the Internet has made it easier to engage students (Simkins, 1999), while offering an abundance of resources, including the use and availability of macroeconomic data (Goffe and Braden 2000; Whiting 2006). Instructors are now able to connect textbook and classroom models to current data. In what follows, we introduce an experiential assignment that simplifies the process of collecting, incorporating and summarizing data, and thus can be used to facilitate learning. Indeed, experiential learning techniques have shown to increase engagement and knowledge retention among students (Hawtrey 2007).

Because many business-type careers (e.g. sales, human resources, public relations, etc.) require the use of data, being able to manipulate and interpret data provides practical knowledge. These problem-solving skills can be transferable to new and unfamiliar situations after college (Brown et al. 1983; Brown, Collins, and Duguid 1989). The purpose of this paper is to provide resources and examples of learning-by-doing strategies that promote two-way interaction in order to improve learning outcomes. Additionally, the hands-

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on experience keeps the course "alive" and it engages and maintains student's interest (Aguilar and Soques 2013). Several intermediate macroeconomics texts come with published graphs from data collected from several sources. While instructors help by interpreting these graphs, students lose out on the opportunity to derive their own graphs thereby making them passive recipients of knowledge accumulation. We share activities that reinforce concepts to students through the accumulation of relevant knowledge, data collection and graph creation. These activities require the instructor to assist the students in accumulating subject-related knowledge, thereby gaining the skills necessary to solve a given problem. The sample exercises provided in this paper will help students understand and retain economic relationships and gain transferable solution strategies by examining economic theories using data.

This paper provides experiential exercises that use the Federal Reserve Economic Data (FRED) database to improve learning outcomes. FRED is a data aggregation site based at the Federal Reserve Bank of St. Louis. It includes more than 236,000 economic education time-series data from more than 65 sources. The data can be accessed through the Federal Reserve Bank of St. Louis website < http://research.stlouisfed.org/fred2/>. In this paper, we focus our exercises on the free FRED Excel add-in. The FRED Excel add-in (see below) is a user-friendly application that allows students to easily collect, manipulate, and graph data. In addition, it reduces the amount of time spent collecting and organizing data. We specifically focus on the Excel add-in feature, as opposed to using the FRED website, to generate graphs in order to encourage hands-on experience. With this feature, students are able view and manipulate the actual data and generate their own graphs.

For these active learning strategies, students are initially introduced to the concepts and then use the knowledge acquired to make specific analytical and conceptual connections to the assigned problems. The examples provided below are geared toward economic theories commonly found in a standard intermediate macroeconomics course. We feel that instructors who teach economic theory without reference to empirical applications leave students to believe that economic models are built using unrealistic assumptions that are not applicable to the real world. Further, we claim that there are added benefits to having students check to see if the data are consistent with theoretical economic relationships. Specifically, the students obtain a greater appreciation and confidence in using economic models to make predictions while at the same time developing a deeper understanding of important economic events and concepts. For instance, time-series plots expose important historical events that can be discussed in reference to the theoretical relationship. From the perspective of the instructor, the FRED Excel application permits customizable graphs, as opposed to textbook-provided graphs, making it easy to update and revise the graphs as new information becomes available. In sum, this active learning approach allows students to check and see if the data are consistent with theoretical predictions of common macroeconomic models, while providing several supplementary benefits.

To our knowledge, there is limited documentation in the economic education literature on using data to improve learning outcomes. Several instructors use the FRED database in their classrooms but their use as an instruction-tool have not been widely documented (McGoldrick 2014).[4] One notable exception is the paper by Méndez-Carbajo (2015), which discusses instructor-led activities using data from FRED to illustrate economic relationships. Simkins (1999) provides an example of an active-learning technique that requires students to replicate the Federal Reserve's Fed Challenge. Students gather regional economic data collected by federal agencies, develop a policy recommendation, and conduct a simulation of a Federal Open Market Committee meeting. Another useful resource is *Starting Point: Teaching and Learning Economics* <http://serc.carleton.edu/econ/index.html> that shares innovative teaching strategies. One resource is the "teaching with FRED" section.[5] It includes several classroom activities and examples provided by economics instructors on ways to use FRED to enhance student learning, quantitative writing and analyses. A separate section titled "teaching with the spreadsheet" promotes the benefits of Excel.[6] It provides several examples that encourage the use of Excel in a classroom setting. Some assignments make use of the FRED data but these data are formatted and provided by the instructor. In this paper, we show students how to access the data using the Excel add-in while motivating them to format the data on their own. Whiting (2006) shares assignments where students mimic a Federal Open Market Committee (FOMC) meeting with the help of data collection. He has his students incorporate real-world data collected

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[4] We are aware of several papers that cover the various uses of technology, most recently social media, in the classroom to improve learning and writing outcomes. These are summarized in Al-Bahrani and Patel (2015).

[5] http://serc.carleton.edu/econ/fred

[6] http://serc.carleton.edu/econ/spreadsheets/index.html

through several sources in their models. Some of the sources include *Resources for Economists*, *the Dismal Scientist*, *FRED*, and the various Federal Reserve branch sites. A 2009 survey among employers stressed the need for greater critical thinking, analytical reasoning and problem solving (Hart Research Associates, 2010). As discussed above, the use of data in problem-solving situations sharpens these skills and produces a deeper understanding of economic concepts. These exercises provide economics students Excel skills that are transferable to both professional and personal settings (Cahill and Kosicki 2001).

Federal Reserve Economic Database (Fred)

FRED is a data aggregation site housed within the research division of the Federal Reserve Bank of St. Louis. It contains more than 236,000 (U.S. and international) time-series data from more than 65 sources. FRED covers a wide range of categories of economic data including, for example, academic data, money, banking and finance, National Accounts, population, employment and labor markets, production and business activity, prices, international data, and U.S. regional data. FRED updates all economic data in real-time and provides users with access to the information in graphical and text form. Users can download the data by importing the data to a spreadsheet or database.

On the FRED website (http://research.stlouisfed.org/fred2/), individuals can create and customize graphs within a web browser. Graphs may be saved to the server and automatically updated. Moreover, users can be informed of any changes by subscribing to the blog (http://fredblog.stlouisfed.org/) or by following FRED on Twitter (@stlouisfed). Other applications allow one to embed FRED data to a personal website or blog, create maps at different levels of aggregation (state, MSA and country levels), and access data using an iPad or tablet. Furthermore, many publishers (e.g. Pearson) now incorporate FRED data and graphs into textbooks (Hubbard and O'Brien 2015) and online software tools (www.myeconlab.com).

FRED Add-In for Microsoft Excel

A unique and beneficial tool for extracting and using FRED data is the "Excel Add-In" that offers free access and use of data from the official database. Once installed, students can browse and instantly download time-series data for any variable of interest. Additional features include transforming the data and changing the frequency. Once the data are downloaded into Excel, students can create graphs and use other Excel features (e.g. Data Analysis) to convert the data into information. Indeed, the clear advantage of the FRED Excel add-in relative to using the website include the ability to use many of the powerful empirical tools of Microsoft Excel (e.g. Anova, Correlation, Fourier analysis, etc.). Given these tools, students can verify the theories using scatter plots, time-series plots, simple regression analysis, and simple correlations. In the sample assignments below, students are asked to check if the FRED data support the macroeconomic theories. Due to the fact that many students are already familiar with Excel, this reduces the challenges of learning new software.[7]

Below are the steps involved in downloading and using the FRED Excel add-in. To install the add-in, use the following link: http://research.stlouisfed.org/fred-addin/install_windows.html

The link provides a step-by-step installation guide. It also has a short video explaining how to get started with data using the FRED add-in. Once the application is downloaded and installed, a tab labeled "FRED" will appear in Excel. The tab provides access to various tools and options to access and manipulate the data. The data-finding tools are separated in terms of popular U.S. data, international data, data releases, and an option to search for a particular dataset. Other data tools include options to choose the frequency and transformation of the data and then build single or multiple-series graphs. Frequency options include daily, weekly, bi-weekly, monthly, quarterly, and annual (not all frequencies are available for all variables). Common transformation options include natural logarithm, percent change, compounded percent change and first difference. Within the FRED tab, users can create both single time-series graphs and multiple time-series graphs with the option of including recession bars. Additional graphing tools and options are provided within Excel.

It is easy and quick to produce a graph using the FRED Excel add-in. For example, generating a graph of the U.S. unemployment rate over time, as shown in Figure 1, involves three steps: (i) Under "Browse

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[7] Students' who may not have experience with using Excel is addressed under the context of use section.

Popular U.S. Data" and "Population, Employment, and Labor Markets" click "Unemployment rate"; (ii) then click "Get FRED Data"; (iii) then click "Build Graph."

Figure 1: Civilian Unemployment Rate

Source: U.S. Department of Labor: Bureau of Labor Statistics/FRED
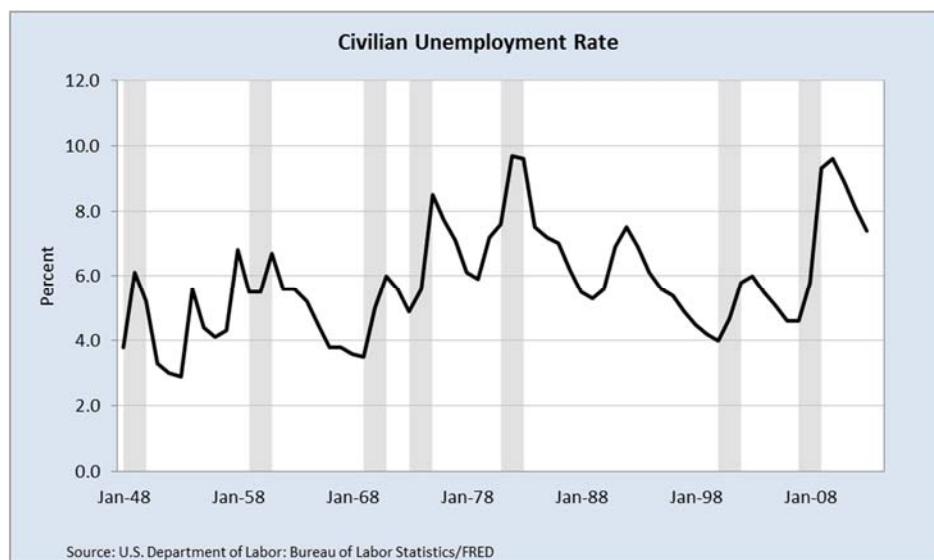
Another nice feature of the FRED add-in is the ability to use other graphing tools within Excel to customize graphs. For example, students are able to add trend lines, labels, title and scales, change the colors, and include data from other sources within the same graph, etc.

Sample Assignments

Below we follow *Starting Point: Teaching and Learning Economics* http://serc.carleton.edu/econ/index.html and outline the summary, learning objectives, context for use, teaching notes and assessment for the sample assignments given.

Summary

In the activities described below, students use actual data to test key macroeconomic theories.[8] The activities follow the material found in the 8th edition *Macroeconomics* textbook by Gregory N. Mankiw, where each theory is discussed followed by a graph of data supporting the theory. In contrast, the forthcoming assignments treat students as active, rather than passive, participants in the learning process by having students create the graphs themselves. Specifically, students collect and analyze data in order to test common economic predictions within specific macroeconomic models. For example, the Quantity Theory of Inflation suggests a positive relationship between growth in the money supply and inflation. To test this theory students collect data on the money supply and price level, plot the growth rate of each variable over time, and then compare the trends in each variable to the predictions of the theory. Although the sample assignments are tailored to suit a standard intermediate macroeconomics class, tasks can easily be adapted to other economics courses. Upon completion of the assignment, students are able to check the consistency of economic models with data, which ultimately reinforces their trust in using models to make economic predictions.

While conducting this assignment in our own class, we follow a simple procedure. First, we discuss the theory within the context of the model. Once the students fully understand the theoretical relationship among the variables of interest, we deliver the assignment to each student and ask them to complete the assignment prior to the next class meeting. Next, we discuss the outcome of the assignments in class.

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[8] It is important to convey to students the difference between "correlations" in the data and "causal" interpretations.

Specifically, we ask if the data confirm the predictions of the theory. We also inquire about other interesting findings (e.g. unexpected changes in the trend, etc.). Finally, we collect feedback on the assignment from each student. For example one student commented "I'm always trying to apply what we're learning in class to the real-world, and this assignment helped to bridge that gap", while another student added "I think the assignment was fun to do, it was a good way to play and interact with the data". Remarkably, one student confessed that her intellectual curiosity encouraged her to use other tools within Excel to further explore the data (e.g. calculating the correlation coefficient). Overall, the feedback from the assignment was positive.

The sample exercises provided below offer a number of potential benefits by: (1) bridging the gap between theory and empirics through active learning; (2) improving students' evaluative skills by examining the relationship between theory and evidence; (3) highlighting significant historical relationships among important variables of interest; (4) learning how to collect, manipulate, calculate and graph data using the tools of Excel; (5) revealing the shortcomings of the models; and (6) developing critical thinking and analytical skills by identifying, analyzing and resolving problems.

Learning Objectives

The purpose of this assignment is to improve quantitative economic literacy (McGoldrick 2014) by providing experience in graphing and analyzing real world data with the intention of checking if the data support important economic theories. In other words, these exercises are intended to improve students' ability to collect, transform, understand, and communicate the data. The learning objectives of this assignment include improving student comprehension and appreciation of economic modeling, learning how to correctly test economic theories using authentic data, and learning how to manipulate data to convey information.

Context for use

These activities can be used as instructor-led examples or as group (or individual) assignments to be completed either in-class or as homework. In order to complete the assignments, students need access to a computer (e.g. computer lab) and Microsoft Excel.[9] Although these exercises are best done in a computer lab, they can easily be done in groups while in a regular classroom if students have access to laptops or tablets. For assignments done in a computer lab or in the classroom, instructors should allocate approximately 30-40 minutes of classroom time with an additional 10 minutes for classroom discussion.

These assignments presuppose basic knowledge of Microsoft Excel. Given that some students may have limited experience using Excel, the instructor is encouraged to provide a short tutorial on Excel before conducting the activity. Because students may be diverse in their experience with Excel a good resource is <http://www.mesa.ca/resources/excel-tutorials/>, which provides a compilation of tutorial videos and articles for beginner, intermediate, and advanced students. As part of the tutorial, the instructor could describe the installation process for the FRED Excel add-in or simply refer the students to the detailed instructions found at http://research.stlouisfed.org/fred-addin/install_windows.html.

Teaching Notes

For instructors planning to adopt these assignments, it is helpful to first describe the theory in class including the necessary assumptions. This shows the usefulness of the theory within the context of the overall model. Another suggestion is to allow the students to work in groups to enhance the learning process. This encourages students to improve their skills by learning from one another. Finally, repeating these exercises for different theories throughout the semester will improve proficiency and enhance learning outcomes.

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[9] Many schools offer Microsoft Office, complete with Excel, for a significant discount to students.

Assessment

To ensure students are meeting the learning goals and objectives, different outcomes may be assessed throughout the course. The layout of the questions for each assignment allows the instructor the ability to weight and grade each part separately. Also, defining points for each question communicates the importance of each question. Therefore, deducting points for each incorrect or incomplete answer pinpoints the learning objective that requires more emphasis. This also provides feedback to the instructor on critical points that need further explanation in class. In the next section, we outline several suggested assignments for implementing this unique active learning strategy.

Macroeconomic Active Learning Sample Activities

There are several theories covered in a typical macroeconomics class that can be brought to the data by using the FRED application. The activities discussed follow the material included in standard intermediate macroeconomics textbooks, such as the 8th edition *Macroeconomics* textbook by Gregory N. Mankiw. We focus on the following three theories:

1. The Quantity Theory of Inflation
2. The Fisher Effect
3. Okun's Law

For each application, we include a sample assignment with a corresponding graph created using the FRED Excel application. Other possible theoretical relationships for this type of assignment include the Phillips curve and investment-savings relationship in a closed versus open economy. The Phillips curve offers a unique example to highlight the lack of stability in the economic relationship between unemployment and inflation over time. This example can be used to highlight the potential problems with using correlations among variables and economic behavior.[10] Below we describe each assignment in turn.

The Quantity Theory of Inflation

This exercise is designed to help students understand the relationship between growth in the money supply and inflation. The economic concepts covered in this activity include: inflation, monetary policy and money supply. Ideally, prior to the assignment the instructor covers the theory behind the Quantity Theory of Inflation in class as summarized below (for details see Mankiw (2013), pp. 105-108).

> ***Theory: A long-run positive relationship between the growth in the money supply and inflation.***
>
> ***Equation: $\pi = g_M - \bar{g}_Y$***

The variables in the above equation include inflation (π), the growth rate of the money supply (g_M), and the growth rate of output ($\bar{g}_Y$).[11] The growth rate of output $\bar{g}_Y$ is exogenous and determined by real factors not monetary factors. After presenting the theory, the instructor delivers the in-class assignment to the students. Table 1 shows a sample assignment that students complete using the FRED Excel application. The theory predicts that inflation is caused by growth in the money supply in the long run. In order to check this empirically, the students collect annual data on M2 money supply and the CPI using FRED. Next, students convert each series into annual growth rates. Alternatively, instructors can assign each group a different decade to facilitate additional learning.

Once the data parameters are set, the data are retrieved and the students plot both series on a different axis within the same graph. Figure 2 provides a sample graph for this portion of the assignment. Students then comment on the relationship between these two variables over time. They should notice that the short-run relationship between the two variables appears to be negative. To promote critical and analytical thinking students are asked to comment on the difference in behavior of the variables over the short run and

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[10] We thank an anonymous referee for pointing this out.

[11] The bars over the variables indicate that these variables are exogenous.
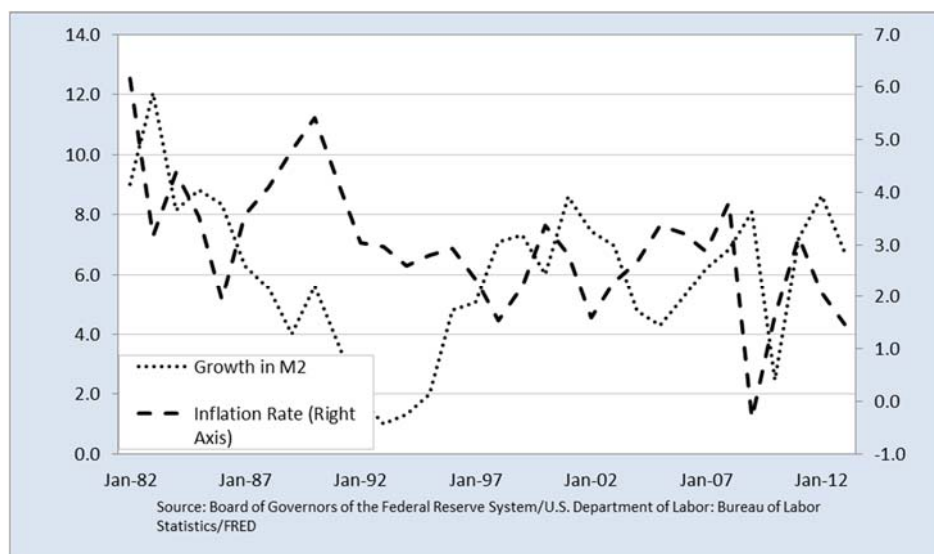
long run. Specifically, the Quantity Theory of Inflation is a theory describing the long-run behavior among the variables. Therefore, the deviation of these variables from the theory is due to the central bank responding to inflation by reducing the money supply.

Table 1: Activity for the Quantity Theory of Inflation

Directions: Please use the FRED Excel add-in to complete this assignment. Follow the instructions carefully and answer all questions.
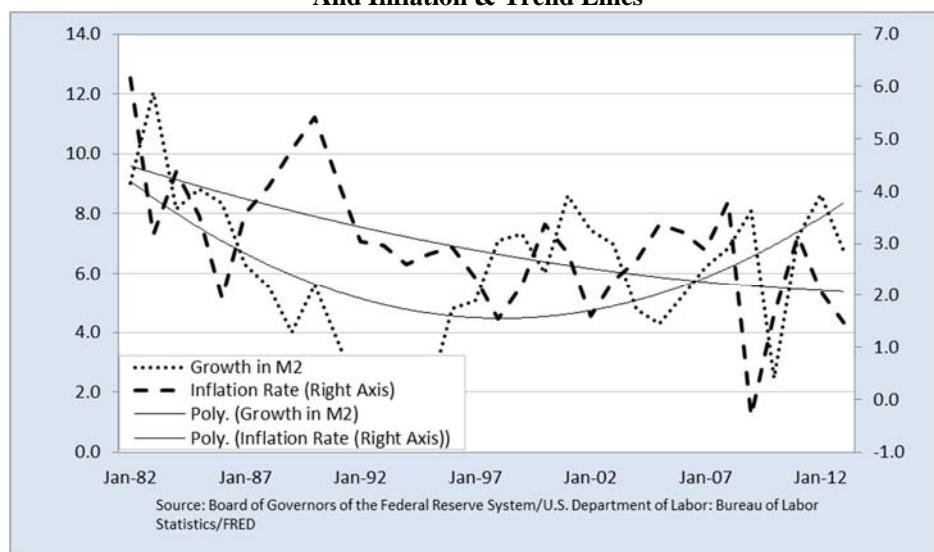
1. Write out the equation for the quantity theory of inflation and explain its predictions.
2. In Excel, click the FRED tab and download data on "M2" and "Consumer Price Index". Choose annual frequency and convert these variables into growth rates by choosing "percent change from a year ago."
3. Choose "Create Multiple Series Graph" and plot the growth in M2 on the primary axis and growth in CPI (inflation) on the secondary axis (be sure to match up the start dates for each series).
4. Describe the relationship between these two variables over time. Does this confirm or refute the quantity theory of inflation? Explain.
5. In order to get a sense of the long-run relationship between these two variables add in a trend line by selecting "Layout" under "Chart Tools." Next click 'Trend Line" and then "More Trend Line Options."   For this part it is easier to use a polynomial of order two. Create a trend line for both variables in the graph. What do these trend lines tell you about the relationship between growth in the money supply and inflation? Does this confirm or refute the quantity theory? Explain.
6. Does your answer to question 5 differ from question 4? Explain.
7. Please attach the graph with your answers to this sheet.

Figure 2: Quantity Theory Of Inflation - Growth In M2 Money Supply And Inflation

Source: Board of Governors of the Federal Reserve System/U.S. Department of Labor: Bureau of Labor Statistics/FRED

In order to illustrate the long-run path of the variables, trend lines are added to the graph (see Figure 3). The sample assignment guides the student to the correct trend line (linear, moving average, exponential, or polynomial). After the trend lines are plotted, students are asked to comment on the long-run relationship between these two variables and relate this back to the theory's predictions. Upon completion of this exercise, students should have a deeper understanding of both the short and long-run relationship between money growth and inflation.

Figure 3: Quantity Theory Of Inflation - Growth In M2 Money Supply And Inflation & Trend Lines

Source: Board of Governors of the Federal Reserve System/U.S. Department of Labor: Bureau of Labor Statistics/FRED

The Fisher Effect

This exercise is designed to help students understand the relationship between interest rates and inflation. The economic concepts covered in this activity include: inflation, nominal interest rates and real interest rates. Again, the instructor begins by covering the theory behind the Fisher Effect as summarized below (for details see Mankiw (2013), pp. 111-113).

> *Theory: A one-for-one relationship between nominal interest rates and the inflation rate*
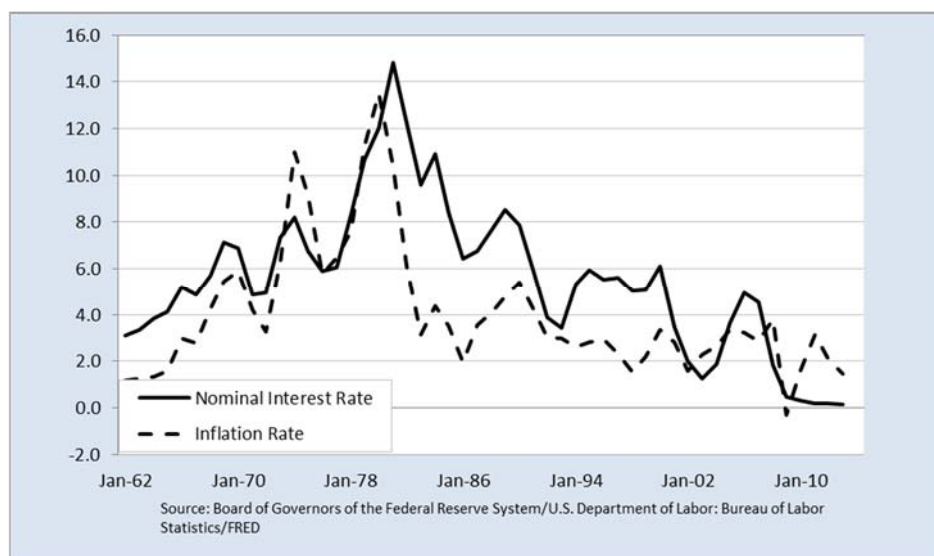>
> *Equation:* $i = \bar{R} + \pi$

The variables in the above equation include nominal interest rates (i), real interest rates ($\bar{R}$), and the inflation rate (π). This theory states that there is a one-for-one long-run relationship between nominal interest rates and the inflation rate. This is because the real interest rate $\bar{R}$ is exogenous and determined by real, rather than nominal, factors.

Table 2 provides a description of the Fisher Effect assignment. Students are initially asked to describe the relation between the Fisher equation and the Fisher effect. Students then collect annual data on 1-year Treasury rates and CPI, and convert CPI to an inflation rate using the "percent changes from a year ago" option in the FRED Excel add-in. Next, the students graph these two series on each axis within the same graph and comment on the relationship while referring back to the concept of the Fisher equation. In addition, it is insightful to have students comment on the relationship over the business cycle. Figure 4 provides a completed sample graph for this assignment—e.g. this graph is equivalent to Figure 5-3 in Mankiw (2013).
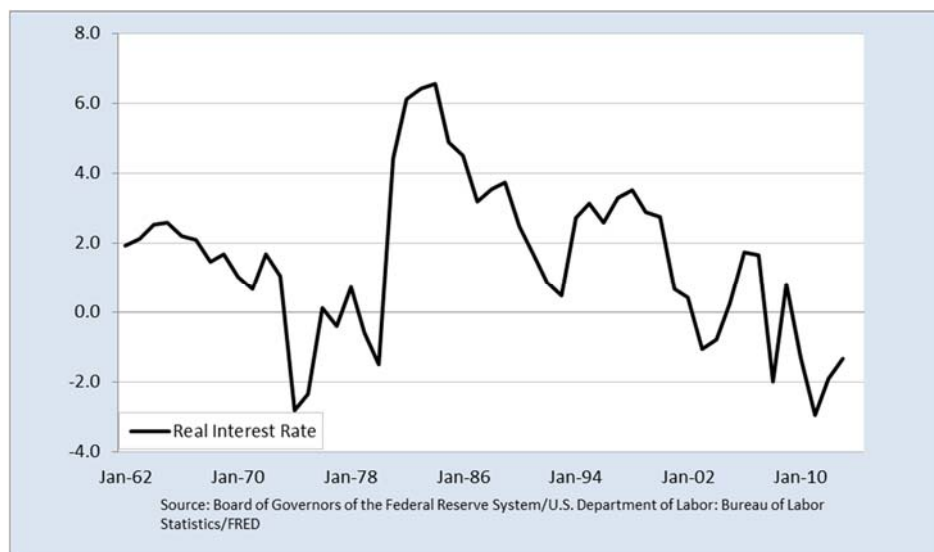
Table 2: Fisher Effect Assignment

Directions: Please use the FRED Excel add-in to complete this assignment. Follow the instructions carefully and answer all questions.

1. What is the Fisher Effect? Write out the Fisher equation and explain what it means and how it relates to the Fisher Effect.
2. In Excel, click the FRED tab and download data on "1yr Treasury rates" and "Consumer Price Index". Choose annual frequency for each series. To get inflation convert CPI to "percent changes from a year ago."
3. Choose "Create Multiple Series Graph" and plot the nominal interest rate on the primary axis and inflation on the secondary axis (be sure to match up the start dates for each series).
4. Describe the relationship between these two variables over time. Does this confirm or refute the Fisher Effect? Explain.
5. Next, in Excel compute the real interest rate from the Fisher equation.
6. Graph the real interest rate on a separate graph.
7. Does the real interest rate become negative at any point? If yes, does this mean the marginal product of capital is negative in those years?
8. Please attach the graph with your answers to this sheet.

Figure 4: Fisher Equation – Nominal Interest Rate And Inflation Rate

Source: Board of Governors of the Federal Reserve System/U.S. Department of Labor: Bureau of Labor Statistics/FRED

A possible extension to this assignment is to require students to calculate the real interest rate implied by the Fisher equation, and then plot a time-series graph of this series (see Figure 5). As shown in Figure 5, the real interest rate is negative over certain periods, which clearly indicates that real interest rates deviate from the marginal product of capital. Again, to stimulate critical and analytical thinking, students should be asked to analyze this irregularity. This will reinforce the idea that variables sometimes behave differently in the short run.

Figure 5: Fisher Equation – Real Interest Rate

Source: Board of Governors of the Federal Reserve System/U.S. Department of Labor: Bureau of Labor Statistics/FRED

Okun's Law

This exercise is designed to help students understand the relationship between unemployment and output. The economic variables used in this activity include: GDP and unemployment. As before, the instructor initially covers the theory behind Okun's Law in class as summarized below (for details see Mankiw (2013), pp. 277-279).

Theory: *An inverse relationship between unemployment and output*
Equation: $U_t - \bar{U} = \gamma \tilde{Y}_t$

Okun's law describes the negative relationship between unemployment and output, where U_t represents the observed unemployment rate; $\bar{U}$ represents the natural rate of unemployment; and the variable $\tilde{Y}_t$ represents the percent deviation of output from its potential. Because the natural rate of unemployment and potential output are unobservable, another useful derivation of Okun's law is described by the following linear equation:

$$g_Y = \mu - \gamma \Delta u_t$$

Here g_Y represents the growth rate of output; μ is the average annual growth rate of real GDP; γ is the slope of the relationship; and Δu_t is the change in the unemployment rate. Notice that the form of the equation is the recognizable *y=mx+b* equation for a line, in which the parameters (i.e. μ and γ) can be estimated using the "best-fit" line within a scatter plot.

Table 3 shows that once the theory is explained, students use data to construct a scatter plot that can then be compared to the theory. Specifically, students gather data on the percent change in real GDP from the year before and the change in the unemployment rate from that period. Once the data are collected, a scatter plot is created. After the students have a chance to comment on the observed relationship (i.e. positive, negative, or no relationship), they will estimate the parameters of the above equation. To do this, the students insert a linear trend line (and include the equation for the line in the graph). The equation provides estimates for the parameters in the model listed above (i.e. μ and γ). Figure 6 provides an example of the completed graph.

Finally, the students are asked to interpret the effect of a one-percentage point increase in the unemployment rate on economic growth, and then comment on the credibility of the parameter estimates.

Table 3: Okun's Law Assignment

Directions: Please use the FRED Excel add-in to complete this assignment. Follow the instructions carefully and answer all questions.

1. What is the equation for Okun's Law and what does it say about the relationship between output growth and unemployment? Be sure to write out the equation and explain the theoretical parameters of the model.
2. In Excel, click the FRED tab and download data on "Real GDP" and "Unemployment rate". Choose annual frequency for each series. Convert Real GDP to "percent changes from a year ago" and Unemployment to "changes from a year ago".
3. For this exercise you need to create a scatter plot. Click the "Insert" tab and then click "Scatter." Choose the first scatter plot. Under "Design" click "select data" and then click "Add". Plot Unemployment on the x-variables and GDP on the y-variable. For the series name use the corresponding dates of the observations.
4. Describe the relationship between these two variables (i.e. positive, negative or no relationship).
5. Next, I want you to add a "best fit" line. Click 'Trend Line" and then "More Trend Line Options." Because Okun's law is a linear relationship click "linear" and then click "Display equation on chart." This will give you the equation for the best-fit line which is an estimate for Okun's law.
6. What are the two estimates for Okun's law given by the equation on the graph. Do these values confirm or refute Okun's law? Explain.
7. If the unemployment rate increased by one percentage point by how would economic growth change according to your estimate? Does this seem believable to you? Explain.
8. Please attach the graph with your answers to this sheet.

Figure 6: Okun's Law – Unemployment And Output Growth

$$y = -1.8414x + 3.336$$
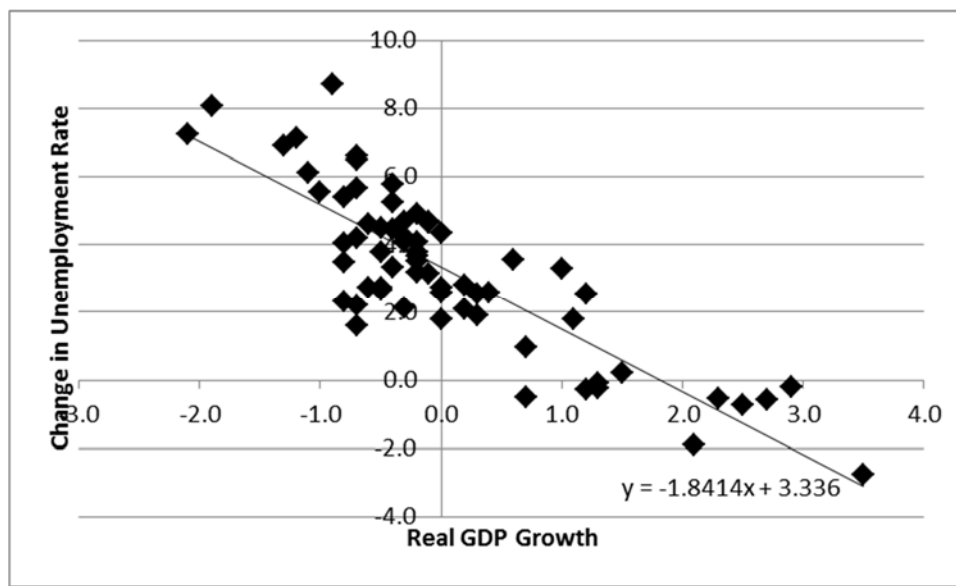
Conclusion

The sample activities described in this paper offer effective ways to help bridge the gap between theory and empirics using active learning. These activities are meant to unleash the inner practitioner in all students by making them active participants in the learning process. This can be accomplished using the recently-developed FRED Excel add-in, which offers many opportunities for instructors to incorporate problem-based active learning strategies and learning-by-doing techniques to provide more intuition behind complex economic models presented in intermediate macroeconomics classes. Through hands-on experience, students benefit by developing a deeper understanding of important economic events, concepts, and relationships. Furthermore, the problem-solving skills learned throughout these activities may be transferable to other situations both inside and outside of academics. For example, understanding how to collect, manipulate, and graph data is a widely applicable skill. From an instructor's point of view, this learning-by-doing strategy facilitates student comprehension of important theoretical relationships and reinforces their understanding and appreciation for economic modeling.

In sum, we feel it is imperative for instructors to seek out and adopt available resources (such as FRED) to utilize active learning strategies that incorporate data into economic courses. The critical thinking, analytical, and quantitative skills learned in these activities enhance students' problem solving skills and greatly improve their overall learning experience.

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Helping Students Crack Annuity, Perpetuity, Bond, and Stock Valuation Formulas

Chengping Zhang [1,2]

Abstract

Mainstream finance textbooks present valuation formulas of annuities, perpetuities, stocks, and bonds, but the texts seldom explain the story behind them, leaving students in the dark about why these formulas work. The aim of this paper is to illuminate the black box of these formulas, thus helping finance instructors and students truly understand them. Starting from the basic valuation principle, we can reach each of these seemingly daunting formulas via a few simple algebraic steps. When students reach their "Ah-ha" moment at the end of each derivation, it motivates them and subsequently boosts their interest and confidence in learning Finance.

Introduction

Business students think finance is the most challenging business subject, and the worst part about finance is those seemingly daunting valuation formulas. One reason behind this is that most current widely-used introductory finance textbooks[3] just present these formulas directly without explaining the origin of them. The rationale and development of each formula is left as a black box. Students can work out related problems by applying the formulas mechanically. However, they do not truly understand the origin of each formula, how each formula is reached, or why the formulas work.

Students may choose to use a financial calculator or Excel built-in functions to solve time value of money (TVM) and valuation problems. But how a financial calculator or Excel solves these problems still remains a mystery to the students. They may not realize that financial calculators and Excel actually use these formulas as well. The formulas are integrated into the programs running on the calculator and Excel, so the users do not see the formulas be applied directly.

The underlying principle behind all of these formulas is that the value of any financial asset is the present value of all expected cash flows from the asset. Without knowing the ins and outs of these basic valuation formulas, students view them in isolation and have trouble grasping them. Consequently, students feel frustrated and discouraged in learning Finance. Unpacking the black box of these formulas will promote students' deep understanding of the subjects and other finance concepts that are built upon them.

Time Value of Money (TVM) Building Blocks

The time value of money is one of the most important and fundamental concepts in finance theory. Understanding the time value of money is essential in making loan, investments, capital budgeting, retirement planning, and many other financial decisions. In this section, we demonstrate how the valuation formulas of annuities and perpetuities can be derived from the basic valuation principle - the value of any financial asset

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[3] See Graham and Smart (2012), Booth, Cleary, and Drake (2012), Ross, Westerfield, and Jaffe (2012), Ehrhardt and Brigham(2013), Brealey, Myers, and Allen (2013), Ross, Westerfield, and Jordan (2013), Gitman and Zutter (2014), Parrino, Kidwell, and Bates (2014), Brigham and Houston (2015), Ross, Westerfield, and Jordan (2015).

is the present value of all future cash flows expected from the asset. The annuity and perpetuity formulas are building blocks for the valuation of other financial securities. We show how stock and bond valuation formulas can be derived from annuity and perpetuity formulas in the "Putting the TVM Building Blocks to Work" section.

The derivations below follow the notations used in Ross, Westerfield, and Jordan (2015), which is a widely used introductory finance textbook in the United States and abroad.

Annuity Valuation

An annuity is a series of cash flows or payments that occur at equal intervals over a period of time. In most cases, annuity payments are equal and can be made at either the beginning or the ending of each period. If the cash flows grow at a constant rate, we would have a growing annuity. We start with the derivation of the present value of an ordinary annuity, in which the payments are made at the end of each period, as shown in Figure 1. Growing annuity is discussed in the next section.

Figure 1. Timeline of Cash Flows from an Ordinary Annuity
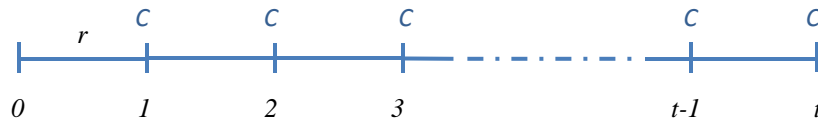
Consider an ordinary annuity with a constant payment of C for t periods and an interest rate of r. The value of an ordinary annuity is simply the present value (PV) of all annuity payments. Mathematically,

$$PV = \frac{C}{1+r} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \cdots + \frac{C}{(1+r)^{t-1}} + \frac{C}{(1+r)^t} \tag{1}$$

We factor out $\frac{1}{1+r}$ starting from the second term on the right-hand side:

$$PV = \frac{C}{1+r} + \frac{1}{1+r}\left[\frac{C}{1+r} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \cdots + \frac{C}{(1+r)^{t-1}}\right] \tag{2}$$

Notice that the expression in the brackets is just the right-hand side of Eq. (1) without the last term, which is: $PV - \frac{C}{(1+r)^t}$. So Eq. (2) can be written as

$$PV = \frac{C}{1+r} + \frac{1}{1+r}\left[PV - \frac{C}{(1+r)^t}\right] \tag{3}$$

Multiplying both sides by $1 + r$ gives us:

$$(1+r)PV = C + PV - \frac{C}{(1+r)^t} \tag{4}$$

Expand the left-hand side:

$$PV + rPV = C + PV - \frac{C}{(1+r)^t} \tag{5}$$

Subtract PV from both sides and factor out C on the right-hand side, we now have:

$$rPV = C - \frac{C}{(1+r)^t} = C\left\{1 - \left[\frac{1}{(1+r)^t}\right]\right\} \tag{6}$$

Finally, we divide both sides by r, and the final formula for the present value of an ordinary annuity is reached.

$$PV = C\frac{1 - [1/(1+r)^t]}{r} \tag{7}$$

$\frac{1-[1/(1+r)^t]}{r}$ is often referred to as the present value interest factor for annuities (PVIF) in Finance textbooks.

Similarly, we can derive the future value of an ordinary annuity. First, we sum up the future values of all cash flows at time t. That is,

$$FV = C(1+r)^{t-1} + C(1+r)^{t-2} + \cdots + C(1+r)^2 + C(1+r) + C \tag{8}$$

We subtract C from both sides and factor $(1+r)$ from the right-hand,

$$FV - C = (1+r)[C(1+r)^{t-2} + \cdots + C(1+r)^2 + C(1+r) + C] \tag{9}$$

Note that the expression in the bracket is exactly the same as the right-hand side of Eq. (8) without the first term, so Eq. (9) can be written as

$$FV - C = (1+r)[FV - C(1+r)^{t-1}] \tag{10}$$

Expand the right-hand side,

$$FV - C = FV + rFV - C(1+r)^t \tag{11}$$

The term FV on both sides cancel each other. After we move terms around, Eq. (11) becomes

$$rFV = C(1+r)^t - C = C[(1+r)^t - 1] \tag{12}$$

Divide both sides by r, we get the future value of an ordinary annuity.

$$FV = C\frac{(1+r)^t - 1}{r} \tag{13}$$

Alternatively, we can find the future value (FV) of an ordinary annuity using the basic TVM relationship

$$FV = PV \times (1+r)^t \tag{14}$$

Note that we have reduced a series of annuity cash flows to a single sum equivalent at time 0 in Eq. (7). We can restate this single sum equivalent at time t to get the future value. Substitute PV in Eq. (14) with the right-hand side of Eq. (7), we obtain

$$FV = C\frac{1 - \left[\frac{1}{(1+r)^t}\right]}{r} \times (1+r)^t = C\frac{(1+r)^t - 1}{r} \tag{15}$$

which is the same as Eq. (13).

For an annuity due, the payments are made at the beginning of each period. Figure 2 shows the timeline of cash flows from an annuity due.

Figure 2. Timeline of Cash Flows from an Annuity Due
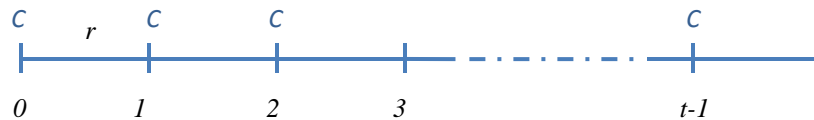
The present value of an annuity due can be written as

$$PV_{Due} = C + \frac{C}{1+r} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \cdots + \frac{C}{(1+r)^{t-1}} \tag{16}$$

We can follow similar steps to derive the present value and future value formulas for an annuity due. For brevity, we do not derive them here. We can also derive the present value of an annuity due from the present value of its corresponding ordinary annuity. Realize that each payment in an annuity due is paid one period earlier than that in an ordinary annuity. Therefore,

$$PV_{Due} = PV \times (1+r) \tag{17}$$

Replace PV with (7) in Eq. (17), we obtain:

$$PV_{Due} = C \times \frac{(1+r)-[1/(1+r)^{t-1}]}{r} \tag{18}$$

Correspondingly, the future value of an annuity due is:

$$FV_{Due} = C \times (1+r) \times \frac{(1+r)^t-1}{r} \tag{19}$$

Growing Annuity Valuation

A growing annuity is an annuity in which the cash flows grow at a constant rate for a specified period of time. Let C be the cash flow in the next period and g be the expected growth rate of the cash flows. The timeline for a growing annuity appears as follows:

Figure 3. Timeline of Cash Flows from a Growing Annuity
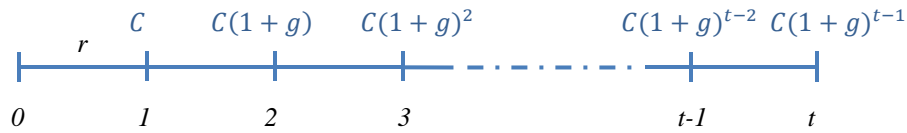
The present value of a growing annuity is then:

$$PV = \frac{C}{1+r} + \frac{C(1+g)}{(1+r)^2} + \frac{C(1+g)^2}{(1+r)^3} + \cdots + \frac{C(1+g)^{t-2}}{(1+r)^{t-1}} + \frac{C(1+g)^{t-1}}{(1+r)^t} \tag{20}$$

We can factor out $\frac{1+g}{1+r}$ starting from the second term on the right-hand side:

$$PV = \frac{C}{1+r} + \frac{1+g}{1+r}\left[\frac{C}{1+r} + \frac{C(1+g)}{(1+r)^2} + \frac{C(1+g)^2}{(1+r)^3} + \cdots + \frac{C(1+g)^{t-2}}{(1+r)^{t-1}}\right] \tag{21}$$

Note that the expression in the brackets is just the PV minus the last term in Eq. (20), so Eq. (21) can be written as:

$$PV = \frac{C}{1+r} + \frac{1+g}{1+r}\left[PV - \frac{C(1+g)^{t-1}}{(1+r)^t}\right] \tag{22}$$

Multiplying both sides by $1+r$, we get:

$$(1+r)PV = C + (1+g)PV - (1+g)\frac{C(1+g)^{t-1}}{(1+r)^t} \tag{23}$$

That is:

$$PV + rPV = C + PV + gPV - \frac{C(1+g)^t}{(1+r)^t} \tag{24}$$

It is clear that PV can be cancelled on both sides. Subtract gPV from both sides and factor PV out on the left-hand side and C on the right-hand side, we get:

$$rPV - gPV = (r-g)PV = C - \frac{C(1+g)^t}{(1+r)^t} = C \times \left[1 - \left(\frac{1+g}{1+r}\right)^t\right] \tag{25}$$

We then divide both sides by $r - g$ and reach the final formula for the present value of a growing annuity:

$$PV = C \times \frac{1-[(1+g)/(1+r)]^t}{r-g} \tag{26}$$

Note that this formula works for a negative g as well, in which case the annuity cash flows are decreasing at a constant rate over time (contraction).

Perpetuity Valuation

A perpetuity is a special case of annuity. In a perpetuity, the stream of equal cash payments is expected to continue forever (perpetually). Figure 4 shows the timeline for a typical perpetuity.

Figure 4. Timeline of Cash Flows from a Perpetuity
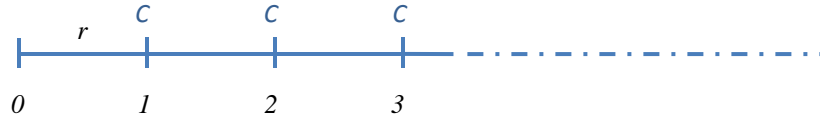
The present value of a perpetuity is then:

$$PV = \frac{C}{1+r} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \cdots \tag{27}$$

Again, we factor $\frac{1}{1+r}$ out starting from the second term on the right-hand side of Eq. (27):

$$PV = \frac{C}{1+r} + \frac{1}{1+r}\left[\frac{C}{1+r} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \cdots\right] \tag{28}$$

Notice that the term in the brackets is exactly the same as the present value of the perpetuity in Eq. (27). Replacing it with PV, and Eq. (28) becomes

$$PV = \frac{C}{1+r} + \frac{1}{1+r}PV \tag{29}$$

Multiply both sides by $1 + r$:

$$(1 + r)PV = C + PV \tag{30}$$

Expand the left-hand side:

$$PV + rPV = C + PV \tag{31}$$

Subtract PV from both sides:

$$rPV = C \tag{32}$$

Dividing both sides by r gives us the present value formula for a perpetuity:

$$PV = \frac{C}{r} \tag{33}$$

We can also derive the perpetuity formula from the present value formula of an annuity in Eq. (7). Note that a perpetuity is a special annuity with an infinite number of payments. That is, $t = \infty$. For any reasonable discount rate r $(r > 0)$, $(1 + r)^t$ goes to infinite when t goes to infinite, and $1/(1 + r)^t$ goes to zero. Therefore,

$$PV = \lim_{t \to \infty}\left(C \times \frac{1-[1/(1+r)^t]}{r}\right) = \frac{C}{r} \tag{34}$$

This is the same formula as shown in Eq. (33).

Growing Perpetuity Valuation

A growing perpetuity is a series of consecutive payments that continue indefinitely, and each payment grows at a constant rate. The timeline of a growing perpetuity with the first payment being C and the cash flow growth rate being g is shown in Figure 5.

Figure 5. Timeline of Cash Flows from a Growing Perpetuity
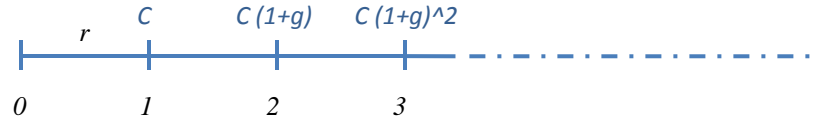
The present value of a growing perpetuity is:

$$PV = \frac{C}{1+r} + \frac{C(1+g)}{(1+r)^2} + \frac{C(1+g)^2}{(1+r)^3} + \cdots \tag{35}$$

We can factor out the common factor $\frac{1+g}{1+r}$ starting from the second term on the right-hand side. Therefore,

$$PV = \frac{C}{1+r} + \frac{1+g}{1+r}\left[\frac{C}{1+r} + \frac{C(1+g)}{(1+r)^2} + \frac{C(1+g)^2}{(1+r)^3} + \cdots\right] \tag{36}$$

Note that the expression in the brackets is exactly the same as the right-hand side of Eq. (35), which is equal to PV. Replace the term with PV, we have:

$$PV = \frac{C}{1+r} + \frac{1+g}{1+r}PV \tag{36}$$

We then solve for PV in a similar way as equations (23) through (26).

$$(1+r)PV = C + (1+g)PV \tag{37}$$

$$PV + rPV = C + PV + gPV \tag{38}$$

$$rPV = C + gPV \tag{39}$$

$$(r-g)PV = C \tag{40}$$

Finally, we divide both sides by $r - g$ and get the present value of a growing perpetuity:

$$PV = \frac{C}{r-g} \tag{41}$$

This formula can also be derived by taking the limit of the present value of a growth annuity in Eq. (26) as t goes to infinite.

Putting the TVM Building Blocks to Work: Bond and Stock Valuations

We have derived the annuity and perpetuity formulas in the previous section. In this section, we will see how the time value of money building blocks can be put together to obtain the bond and stock valuation formulas.

Bond Valuation

A bond is a debt instrument issued by a government or corporation to raise capital. The issuer promises to pay interest periodically and principal at maturity to the bondholders according to the terms and conditions of the bond. Let us assume a bond that pays a coupon payment of C dollars each period, has a face value of F dollars and t periods remaining until maturity. The cash flows from this bond are illustrated in Figure 6.

Figure 6. Timeline of Cash Flows from a Typical Bond
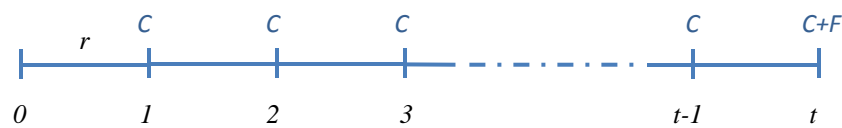
It is clear that the cash flows from a bond can be viewed as an ordinary annuity (with equal coupon payments C) and a lump sum (the par or face value F) to be paid at maturity. So the value of a bond should be the sum of the present value of an annuity and the present value of a lump sum.

$$\text{Bond value} = \boxed{\frac{C}{1+r} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \cdots + \frac{C}{(1+r)^{t-1}} + \frac{C}{(1+r)^t}} + \boxed{\frac{F}{(1+r)^t}}$$

PV of an Ordinary Annuity + PV of a Lump Sum

We have derived the present value formula of an ordinary annuity which is shown in Eq. (7). For a payment of F dollars that will be made t periods from now, its present value is simply $\frac{F}{(1+r)^t}$. Therefore,

$$\text{Bond value} = \frac{C}{1+r} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \cdots + \frac{C}{(1+r)^{t-1}} + \frac{C}{(1+r)^t} + \frac{F}{(1+r)^t}$$

$$= C \times \frac{1 - 1/(1+r)^t}{r} + \frac{F}{(1+r)^t} \tag{42}$$

Stock Valuation

A stock is a share of ownership in a corporation. Companies issue stocks as a means of raising money to fund further business growth. The issuing company is expected to pay dividends to its shareholders. Assume the dividend payments from a hypothetical stock are as follows:

Figure 7. Timeline of Cash Flows from a Hypothetical Stock
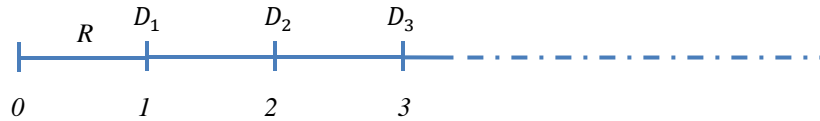
The price of a stock is the present value of all its future dividend payments. For a stock that pays dividends of D_1 in period 1, D_2 in period 2, D_3 in period 3, etc., the price of the stock is then:

$$P_0 = \frac{D_1}{1+R} + \frac{D_2}{(1+R)^2} + \frac{D_3}{(1+R)^3} + \cdots \tag{43}$$

where R is the required rate of return on the stock.

We now make some assumptions about the pattern of future dividend payments. Following the mainstream introductory corporate finance textbooks, we consider the following three special cases.

Zero Growth

If a stock pays a constant dividend, that is, the dividend growth rate is zero, then

$$D_1 = D_2 = D_3 = \cdots = D \tag{44}$$

In this case, the dividend stream can be viewed as an ordinary perpetuity. Using the perpetuity valuation formula in Eq. (33), we conclude that the price of the stock would be:

$$P_0 = \frac{D}{R} \tag{45}$$

This is the formula to calculate the price of a preferred stock, as preferred stocks pay constant dividends over time.

Constant Growth (Dividend Growth Model)

In the Dividend Growth Model, we assume the dividends grow at a constant rate g. Therefore,

$$D_2 = D_1(1 + g) \tag{46}$$

$$D_3 = D_2(1 + g) = D_1(1 + g)^2 \tag{47}$$

$$... ...$$

$$D_t = D_{t-1}(1 + g) = D_1(1 + g)^{t-1} \tag{48}$$

Substituting these dividends in Eq. (43), we have:

$$P_0 = \frac{D_1}{1+r} + \frac{D_1(1+g)}{(1+r)^2} + \frac{D_1(1+g)^2}{(1+r)^3} + \cdots \tag{49}$$

Comparing Eq. (47) with Eq. (35), we should realize that a stock paying dividends that grow at a constant rate is actually a growing perpetuity. So we apply the present value of a growing perpetuity formula (41) here and get the Dividend Growth Model:

$$P_0 = \frac{D_1}{R-g} \tag{50}$$

If we know the dividend just paid, D_0, instead, the expected dividend payment for the next period is then $D_1 = D_0(1 + g)$. So the stock price can be written as:

$$P_0 = \frac{D_0(1+g)}{R-g} \tag{51}$$

We can, in turn, find the expected return of a stock from its observed market price P_0 using the dividend growth model. Multiplying both sides of Eq. (50) by $\frac{R-g}{P_0}$ gives us:

$$R - g = \frac{D_1}{P_0} \tag{52}$$

Add g to both sides to get the expected return:

$$R = \frac{D_1}{P_0} + g \tag{53}$$

Alternatively, if we know D_0 instead of D_1, the expected return is then:

$$R = \frac{D_0(1+g)}{P_0} + g \tag{54}$$

The first term on the right-hand side of Eqs. (53) and (54) is called the dividend yield. The second part of the expected return is the dividend growth rate, g. It is also the rate at which the stock price grows. Thus, the dividend growth rate can also be interpreted as the capital gains yield.

Non-constant Growth (Supernormal Growth Model)

Some firms may experience higher than normal growth in dividend payments for a limited time. After this supernormal growth period, the dividend is expected to grow at a sustainable rate. Consider the case of a firm whose dividend grows at a faster rate g_1 for t periods and then grows at a more sustainable rate g_2 thereafter, as illustrated in Figure 8.

Figure 8. Non-constant Dividend Growth
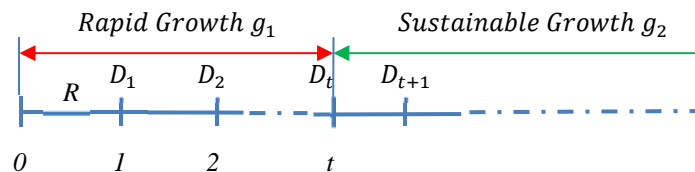
Clearly, the dividend stream after t years is a growing perpetuity. Applying the growth perpetuity formula (41) or dividend growth model (50) or (51), we find the value of all future dividend payments starting from D_{t+1} at period t:

$$P_t = \frac{D_{t+1}}{R-g_2} = \frac{D_t(1+g_2)}{R-g_2} \tag{55}$$

This is called the terminal value or horizon value. We can now calculate the value of the stock at time 0 as the present value of dividend payments in the first t periods plus the present value of the terminal value.

$$P_0 = \frac{D_1}{1+R} + \frac{D_2}{(1+R)^2} + \cdots + \frac{D_t}{(1+R)^t} + \frac{P_t}{(1+R)^t} \tag{56}$$

Conclusion

The annuity, perpetuity, bond, and stock valuation formulas seem daunting to many business and finance students. Finance instructors often follow textbooks to present these formulas to students directly without explaining the story behind these formulas, leaving students in the dark to wonder why and how these formulas work. Mainstream finance textbooks should at least devote a little more text to explaining the origin of these formulas. The goal of this paper is to illuminate the black box, thus helping finance instructors and students to truly understand annuity, perpetuity, bond, and stock valuation formulas. The main section of this paper can be included as an appendix in introductory finance textbooks.

Instructors should remind students that no matter how complex a valuation formula seems at first glance, it is all built upon the basic time value of money building blocks. Spending a few minutes of class time deriving the valuation formulas will alleviate students' anxiety and fear of these formulas. At the end of each derivation, students can experience some great "Ah-ha" moments and subsequently become more motivated. Going through the derivations not only helps students to truly understand these formulas, but also sharpens students' quantitative skills and boosts their confidence and interest in learning finance.

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Textbook Confessions: Of Failures, Markets, and Government

Hugo Eyzaguirre, Tawni Hunt Ferrarini, and J. Brian O'Roark[1]

Abstract

Most undergraduate students come into contact with an economics class only in passing. The textbook will thus be the basis for their economic understanding, and what is included in these books will have a large influence on how they view the workings of the overall economy. Guided by the Council for Economic Education's *Voluntary National Content Standards*, we show that most textbooks cover more extensively market failure than government failure, or even the government role as protector of property rights. We believe a more balanced approach provides an accurate view of the role government should play in a vibrant economy.

Introduction

Most students at the undergraduate level will come into contact with a formal economics course only in passing. Even most business school students are required only to take principles of micro and macro. Therefore, the content of such classes will become their lone window into the world of economics. Additionally, and understandably, instructors are guided by the content of their chosen textbook, therefore, what is in the textbooks will disproportionately influence students' education.

For the most part, content coverage in textbooks varies only at the margin. Some topics, however, are less well represented than others, and as teachers and researchers we all have areas we would like to see covered more or less in principles texts. In the literature on textbooks, there is attention paid to the lack of coverage of some topics, while others consider the location of material rather than the material itself. For example, Phipps, Strom and Baumol (2012) concentrate on the inclusion of entrepreneurship while Lee (1992) examines the placement of international topics.

Following previous work we are interested in the way textbooks address the role of government. Here we build on prior research that examines the degree to which textbooks cover government failure relative to market failure. Gwartney and Shaw (2013) discuss the failure of principles courses to address a variety of subjects related to government and market failure such as the role of private ownership, the competitive process, entrepreneurship, and public choice and the tendency to put an undue emphasis on the role of the central planner. The shortcoming of this article is the lack of specifics regarding how courses and textbooks cover these topics. Eyzaguirre, Ferrarini and O'Roark (2014) provide a more systematic measure of the treatment of government and market failure. They find that while the coverage of market failure is a traditional topic in textbooks, government failure does not receive nearly as much attention. Similarly Fike and Gwartney (2015) examine the extent to which texts cover topics of public choice, government and market failure. They find that market failure is addressed nearly six times more often than government failure in their sample of textbooks.

In order to present a more well-rounded view of the coverage of the role of government, this paper examines the extent to which legal and institutional infrastructure provided by government appears in the pages of college textbooks. The reason for this analysis is that most textbooks present market failure as a result of unclear property rights. It would seem somewhat difficult for college students to grasp this point if the coverage of property rights and other relevant institutions is lacking in their textbooks.

The paper proceeds as follows: Section 2 addresses our methodology. Section 3 provides an analysis of our findings and Section 4 concludes.

Methodology

Our analysis begins with the Council for Economic Education's *Voluntary National Content Standards* (hereafter referred to as the Standards). According to the authors of the Standards:

> The *Voluntary National Content Standards in Economics* provide a tool for educators, specifying what students, kindergarten through grade 12, should learn about basic economics and the economy as they go through school, so that they will be better-informed workers, consumers and producers, savers and investors, and most important, citizens. (ix)

Generally, these standards cover non-controversial topics such as the role of scarcity, incentives, and trade. According to the Standards:

> The standards focus on the more fundamental economic ideas and concepts that are widely shared by professional economists. Some very important aspects of economics are either quite complex or so controversial that there seems to be no existing consensus. In spite of their importance, such complex or controversial aspects of economics receive less attention in the standards for pedagogical reasons. In addition, those aspects of economics that are more easily separated into independent components account for more of the standards. (vii)

Relying on the Standards as our guide allows us to employ a more objective criterion to assess textbook coverage. The Standards is a document in which experts in economic education identify what they consider to be the most relevant topics for high school students to understand prior to graduation. While we are concerned about college textbooks, there is no accepted college level standard against which to compare college textbook material. As the authors of the standards are all themselves college educators, and students in principles classes come from a variety of backgrounds in terms of their formal economic education, we feel that the Standards provide us with the best available point from which to launch our analysis.

Our focus is on Standard 10 of the Standards that states that students should be able to "describe the roles of various economic institutions and explain the importance of property rights in a market economy." (24) In order to arrive at a quantitative measure for the coverage of property rights and other formal institutions, we follow a procedure similar to that in the literature. We define the terms of our search and then examine a set of textbooks to evaluate the extent of the coverage of these topics. Fike and Gwartney (2015), Kent and Rushing (1999), and Lee (1992), count the number of pages devoted to the topic to measure intensity of coverage, and we will do the same.

We have selected twelve textbooks as a basis for our survey. We chose these texts for a couple of reasons. First, these texts were chosen to cover both new and longer running books, the newest being Cowen and Tabarrok in its second edition and the longest running text being McConnell, et al in its 19th edition. Second, these texts appeared at the top of the list in a search of best sellers on Amazon.com. We left out any book in its first edition as such texts haven't yet gone through the revision process. The list of texts appears in Table 1.

Government plays an important role in establishing the rules of the game constraining and enabling economic actors. Standard 16 (hereafter simply referred to as "Standard" followed by the appropriate number) states that:

> There is an economic role for government in a market economy whenever the benefits of a government policy outweigh its costs. Governments often provide for national defense, address environmental concerns, define and protect property rights, and attempt to make markets more competitive. Most government policies also have direct or indirect effects on people's incomes. (38)

Therefore, recognizing the role of well-defined and well-protected property rights as part of how

government participates in an economy helps students to develop a more complete picture of how the economy works; however, property rights do not exist in a vacuum. They are instrumental in the identification of market failure. If government fails to defend property rights, there should be more market failure. Therefore our approach to detailing coverage of property rights takes on a multifaceted approach. We will be adding a page count of institutions to a page count of government failure and comparing that with the coverage of market failure. This, we hope, will provide a clearer picture of how textbooks address what government should be doing (protecting property rights) and the unintended consequences of government action (government failure) relative to a textbook's analysis of market failure.

Table 1: Textbooks

Title	Edition	Author	Publisher	Year	# Pages
Economics: Principles & Policy	12th	Baumol, William J. & Blinder, Alan S.	South-Western CENGAGE Learning	2012	880
Principles of Economics	10th	Case, Karl E. Fair, Ray C. Oster, Sharon E.	Prentice Hall	2012	816
Economics	8th	Colander, David	McGraw-Hill Irwin	2009	1020
Modern Principles of Economics	2nd	Cowen, Tyler Tabarrok, Alex	Worth Publishers	2013	900
Principles of Economics	5th	Frank, Robert Bernanke, Ben	McGraw-Hill Irwin	2013	896
Economics: Private and Public Choice	14th	Gwartney, James D. Stroup, Richard L. Sobel, Russell S. Macpherson, David A.	South-Western CENGAGE Learning	2013	816
Economics	4th	Hubbard, R. Glenn O'Brien, Anthony	Prentice Hall	2013	1152
Economics	3rd	Krugman, Paul Wells, Robin	Worth Publishers	2013	1200
Principles of Economics	6th	Mankiw, N. Gregory	South-Western CENGAGE Learning	2012	888
Economics: Principles, Problems & Policies	19th	McConnell, Campbell R. Brue, Stanley L. Flynn, Sean M.	McGraw-Hill Irwin	2012	896
Economics: A Contemporary Introduction	9th	McEachern, William A.	South-Western CENGAGE Learning	2012	832
Economics Today	16th	Miller, LeRoy	Prentice Hall	2012	840

This means we will be counting pages in three areas: market failure, government failure, and the institution of property rights.

Market Failure

Market failure is dealt with specifically in Standard 16 and this type of failure is covered extensively in all texts in our sample. This is not surprising as topics such as externalities and monopoly have been included in texts for decades.

From Standard 16 market failures include public goods, externalities and a lack of competition. To ensure more complete coverage of market failure we also include regulation related to externalities. Additionally, we reviewed Standard 9, Competition and Market Structure, to determine the cases considered under lack of competition. Standard 9 states that:

> Competition among sellers usually lowers costs and prices, and encourages producers to produce what consumers are willing and able to buy. Competition among buyers increases prices and allocates goods and services to those people who are willing and able to pay the most for them.

After reviewing both Standards 9 and 16, we decided to include monopoly, oligopoly, collusion, antitrust policies, and regulation of monopolies as part of our count of market failure. We leave out monopolistic competition from this list as this market structure is closer to the perfectly competitive side of the spectrum and tends to be looked at with a more favorable eye in terms of the level of competition. Additionally, Standard 9 uses fast-food restaurants as its example of how competition benefits consumers. This is actually monopolistic competition rather than perfect competition.

We do create a significant distinction within the scope of market failure by addressing it with and without a market structure component. While monopolies, for example, can be considered a market failure as prices rise and output falls, monopoly creation is not always a strict market phenomena. Government granted monopolies comprise a fair portion of monopolized industries so we calculate page counts for two different subsets of market failure, one with monopoly considered and one without.

Another type of market failure discussed in Standard 9 refers to the importance of consumer information for the market system to work properly. Specifically, Standard 9 states:

> Students will understand that:
> The level of competition in an industry is affected by the ease with which new producers can enter the industry, and by consumers' information about the availability, price and quantity of substitute goods and services.

 In order to present as complete a picture of market failure as possible we include references to incomplete information in our page count as well.

So, to sum up, based on Standards 9 and 16, our page count for market failure covers the following six areas:

1. Public goods
2. Externalities and regulation related to externalities
3. Monopoly, antitrust and general regulation of monopolies
4. Oligopoly
5. Collusion
6. Incomplete information

Government Failure

We also count the number of pages devoted to the topic of government failure. This is addressed by Standard 17, which says:

> Students will understand that:
> Costs of government policies sometimes exceed benefits. This may occur because

of incentives facing voters, government officials, and government employees, because of actions by special interest groups that can impose costs on the general public, or because social goals other than economic efficiency are being pursued.
Students will be able to use this knowledge to:
Identify some public policies that may cost more than the benefits they generate, and assess who enjoys the benefits and who bears the costs. Explain why the policies exist.

Based on this standard we identify nine topics that textbooks should cover when addressing government failure, and then count the number of pages where these ideas are covered. More detail on this subject can be found in Eyzaguirre, Ferrarini and O'Roark (2014). These topics are:

1. Costs of government policies sometimes outweigh the benefits for society making these policies inefficient.

2. Voters, government officials, and government employees face their own incentives. (Government is not neutral.)

3. There are costs involved in gathering and using information about different candidates and government programs. As a result voters tend to be rationally ignorant.

4. Political incentives lead to shortsightedness.

5. Politicians have incentives to implement policies that disperse costs widely over large groups who each pay only a little and may not recognize the full costs and benefits.

6. By influencing government policy special interest groups can impose costs on the general public.

7. Government policies can sometimes lead to adverse economic outcomes because of the moral hazard problem.

8. In some cases, unintended consequences of government policy distort incentives in the market, resulting in social inefficiency.[2]

9. Majority rule can lead to inefficient outcomes.[3]

Institutions

Defining institutions can be a bit tricky. Standard 10 states:

Students will understand that:
Institutions evolve and are created to help individuals and groups accomplish their goals. Banks, labor unions, markets, corporations, legal systems, and not-for-profit organizations are examples of important institutions. A different kind of institution, clearly defined and enforced property rights, is essential to a market economy.
Students will be able to use this knowledge to:
Describe the roles of various economic institutions and explain the importance of property rights in a market economy.

Our purpose in evaluating coverage of institutions is to specify how those institutions relate to market failure. While the Standards reference many different types of institutions we are narrowly focused on property rights. Therefore, we do not include the analysis of financial institutions among our count. Specifically, we examine topics from two of the Standards.

Standard 10 states that "The incentives to invest, produce and exchange efficiently are affected by the legal and institutional framework". Thus, we count any mentions of the following:

1. Clearly defined and enforced property rights
2. Contract enforcement

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[2] From Standard 1: Scarcity. See Voluntary National Content Standards in Economics (2010) for details. Stable URL: http://www.councilforeconed.org/resource/voluntary-national-content-standards-in-economics/

[3] From Standard 3: Allocation, majority rule is mentioned as an allocation method, though not its problems. See Voluntary National Content Standards in Economics (2010) for details. Stable URL: http://www.councilforeconed.org/resource/voluntary-national-content-standards-in-economics/

   3. Liability rules

Standard 15 also notes the importance of institutions for economic growth. We therefore add two more concepts to our list:

   4. Long term growth depends on the institutional arrangement
   5. Having an institutional framework that rewards successful innovation and investments (through copyrights and patents for example), creates incentives that result in the increase of the rate of productivity

If the texts we are examining cover institutions in any of these ways we include that in our page count.

Counting Process

As is common in the literature, and noted above, we conduct a count of the number of pages on which these three topics are discussed within a textbook. From here we combine the page count totals of property rights/institutions and government failure. We then form ratios to identify the percentage of a text that deals with a particular topic to assess the relative coverage. In some cases, we combine government failure and institutions to compare the coverage of these two topics with the traditional coverage of market failure.

Since some may argue that a market structure short of perfect competition can be considered a market failure, we include two versions of our count. The first includes uncompetitive market structures such as monopoly, oligopoly and antitrust discussions in the count of market failure. The second drops these market structure references. The ratios include:

- Pages devoted to government failure against pages devoted to market failure
- Pages devoted to government failure against pages devoted to market failure - dropping the coverage of market structure, like monopoly, oligopoly, antitrust.
- Pages devoted to government failure added to the pages devoted to property rights/institutions against pages devoted to market failure
- Pages devoted to government failure added to the pages devoted to property rights/institutions against pages devoted to market failure - dropping the coverage of market structure, like monopoly, oligopoly, antitrust

This approach does have one significant shortcoming as it does not address intensity of coverage, yet it gives us a picture of what textbook authors are choosing to include in their pages. Nevertheless, to further highlight the intensity with which authors deal with topics of institutions we examine the glossary and index of each textbook. We look at four topics within the glossary and the index to see if they appear with the assumption that if a word or term is formally defined in the glossary, or if it is referenced in the index, there is a more concerted effort to present that topic in the text. Our four topics, and variations of those topics, include: institutions (other than specific reference to financial institutions); private property; property rights; and rule of law.

Observations

College textbooks appear to place very little emphasis as a percentage of pages on either the topic of government failure or property rights/institutions (hereafter referred to only as property rights). Table 2 reports the percentage of pages devoted to the property rights, government failure, and market failure as a share of the text.

Column 1 addresses property rights. In most cases, save the Krugman and Wells text, property rights are dealt with less than cases of government failure, which in and of itself is not extensively covered. Between 0.07 percent (Colander) and 0.83 percent (Cowan and Tabarrok) of pages are devoted to a discussion of property rights and other institutions. So, despite the vital role that property rights play in explaining market failure and the importance of government in protecting these rights for economic growth, textbooks devote less than one-percent of their total pages to covering the topic.

Table 2: Coverage ratios

Authors	(1) Property Rights & Institutions	(2) Govern ment Failure	(3) = (1) + (2) Subtotal Govern ment	(4) Market Failure	(5) = (1)/(4) Ratio 1	(6) = (3)/(4) Ratio 2	(7) Market Failure (no market structure)	(8) = (1)/(7) Ratio 3	(9) = (3)/(7) Ratio 4
Baumol & Blinder	0.11	0.80	0.91	12.23	6.54	7.44	6.25	12.80	14.56
Case et al	0.21	0.49	0.70	7.05	6.95	9.93	2.76	17.75	25.36
Colander	0.07	0.10	0.17	5.69	1.76	2.99	1.67	5.99	10.18
Cowen & Tabarrok	0.83	1.89	2.72	6.22	30.39	43.73	3.44	54.94	79.07
Gwartney et al	0.61	2.21	2.82	3.68	60.05	76.63	1.47	150.34	191.84
Frank & Bernanke	0.30	0.56	0.86	9.21	6.08	9.34	5.80	9.66	14.83
Hubbard & O'Brien	0.09	0.35	0.44	6.29	5.56	7.00	2.78	12.59	15.83
Krugman & Wells	0.08	0.00	0.08	5.96	0.00	1.34	2.63	0.00	3.04
Mankiw	0.28	1.14	1.42	8.56	13.32	16.59	3.83	29.77	37.08
McConnell et al	0.22	1.12	1.34	6.47	17.31	20.71	2.06	54.37	65.05
McEachern	0.36	1.32	1.68	8.65	15.26	19.42	3.73	35.39	45.04
Miller	0.12	0.48	0.60	7.08	6.78	8.47	1.90	25.26	31.58

Government failure is covered only slightly more, as seen in Column 2 of Table 2, receiving between zero percent (Krugman and Wells) and 2.21 percent (Gwartney, et al.) of pages. Textbook authors devote many more pages to market failure than property rights or government failure. Coverage of market failure comprises between 3.68 percent (Gwartney, et al.) and 12.23 percent (Baumol and Blinder) of pages when all market failure is considered, as shown in Column 3, and drops to between 1.47 (Gwartney, et al.) and 6.25 (Baumol and Blinder) when we remove the market structure component of market failure, as displayed in Column 7. Figure 1 illustrates the differences in coverage among the books surveyed.

Figure 1
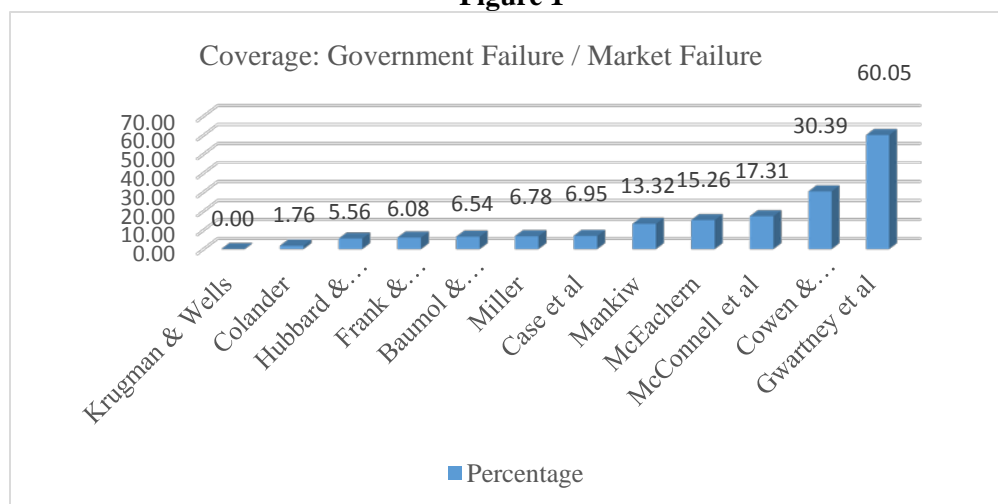
Figures 2 and 3 reflect the particular ratios of government failure and property rights to market failure (Columns 5 and 6 of Table 2). Figure 2 shows the ratio of government failure to market failure. A ratio of 100 would indicate perfectly balanced coverage between government and market failure. This shouldn't necessarily be the goal of a textbook, nor do we expect this. The analysis of market failure tends to be rather technical necessitating more pages to help explain these ideas to students. As a result, the ratio for all texts is less than 100 meaning the coverage of market failure is more prevalent than that of government failure; however, there is extreme variation between the books we reviewed. After adding the page count for institutions to the government failure pages, the ratio remains below 100, but the differences between the texts becomes more dramatic. This is shown in Figures 4 and 5, which display the ratios of pages of government failure and government failure plus property rights to market failure without the market structure component.Interestingly Gwartney et al. is the only textbook with a ratio of government failure and property rights to market failure greater than 100 once the market structure is taken out of the market failure page count. This means that there is more material devoted to government failure than to the discussion of market failure. This gap is accentuated when we add the pages for property rights.

Figure 2

Figure 3

Figure 4

Coverage Ratio: Government Failure / Market Failure (no market structure)
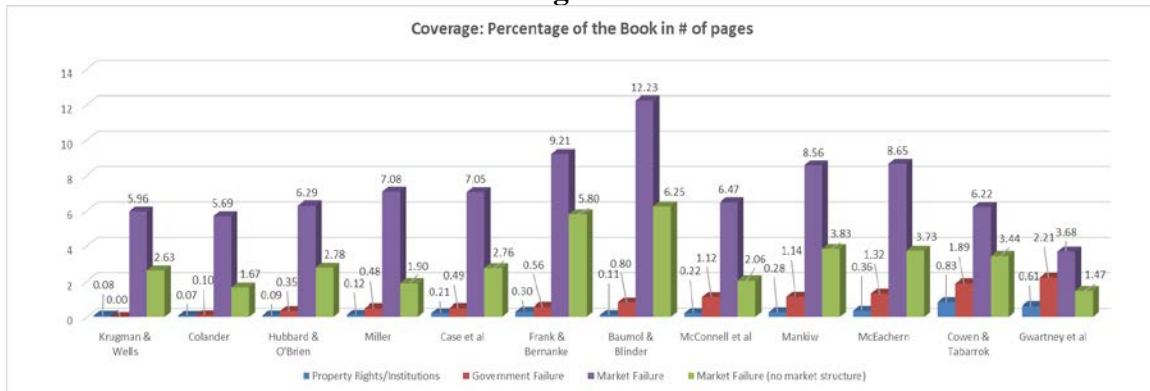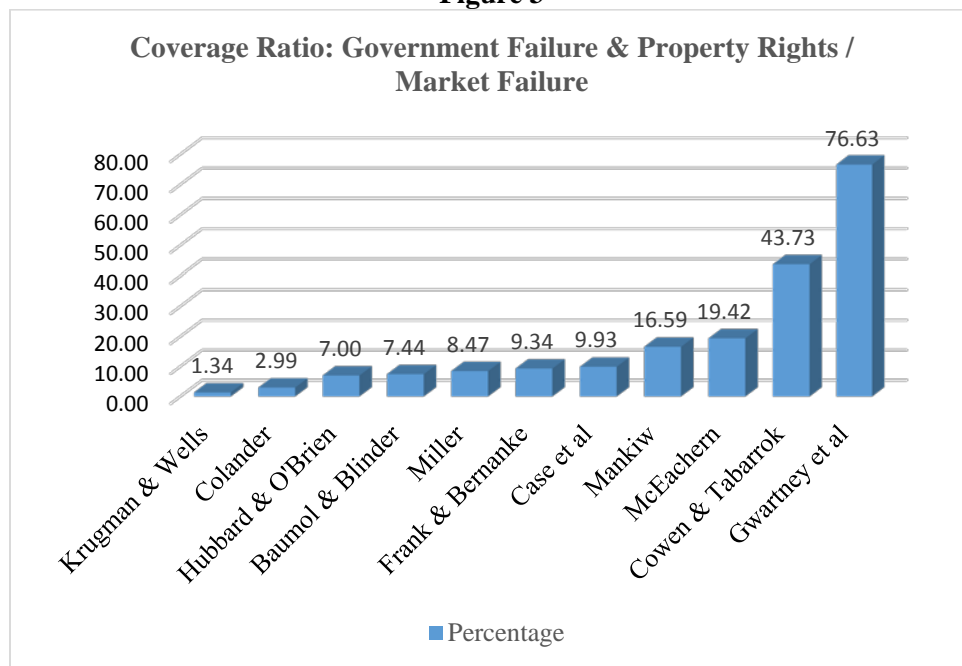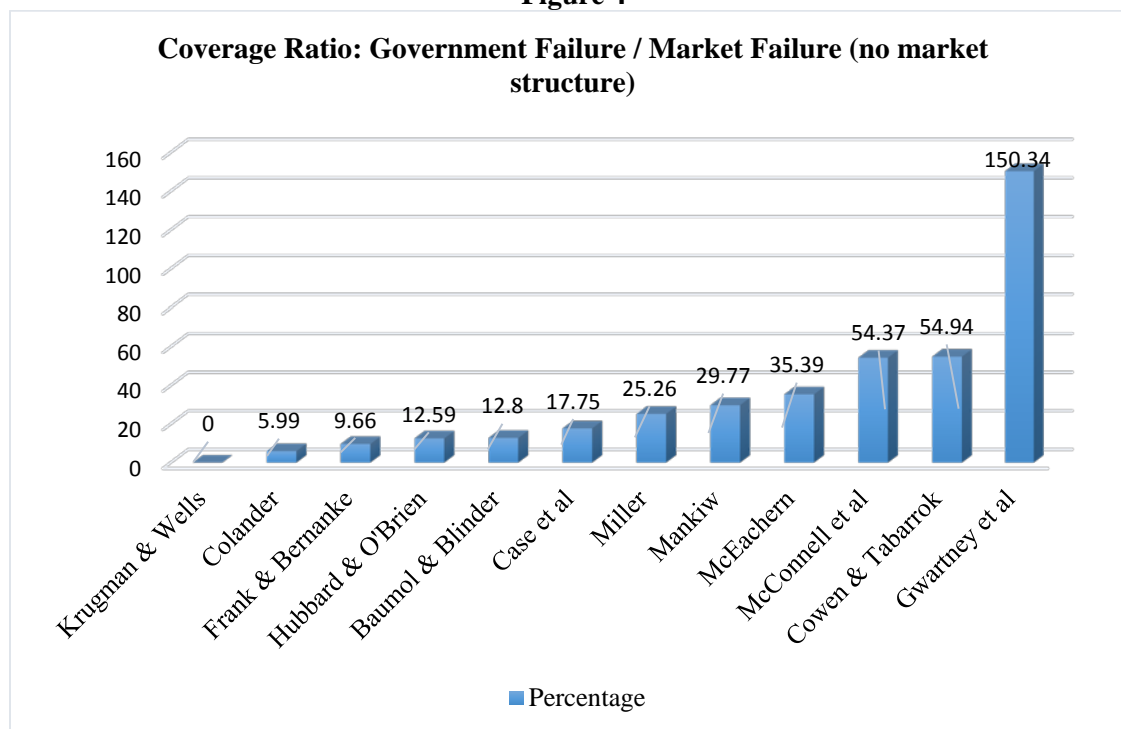
Between the upper bound of Gwartney, et al. and the lower bound of Krugman and Wells we find that the number of pages covering government failure corresponds to roughly 10 percent of the number of pages covering market failure. When we add the pages for property rights to those of government failure the difference increases slightly to 14 percent as many pages. Regardless, for the majority of texts there is obviously much greater attention granted to market failure than to either government failure or the institution of property rights.

Figure 5

Coverage Ratio: Government Failure & Property Rights / Market Failure (no market structure)
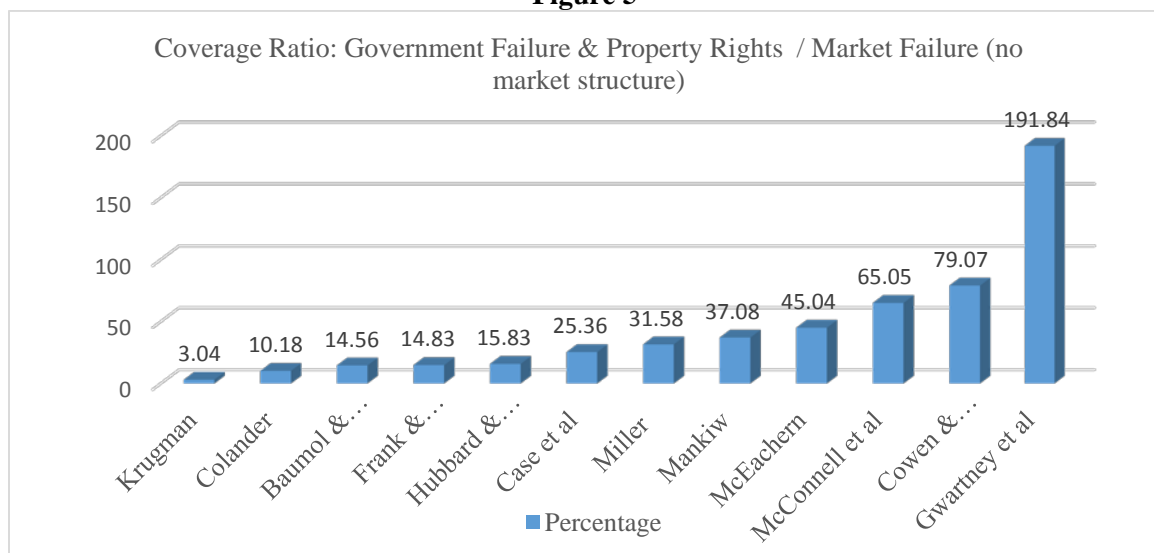
These results are supported when we turn to the glossary and index. Using our terms and variations of the terms institutions, property rights, private property and the rule of law, we see that other than the term property rights, institutional terminology is formally defined infrequently. Some texts, specifically Case and Fair, and Frank and Bernanke, do not define any term related to institutions at all. Institutions and private property are defined in less than half of the sample, and the rule of law only appears in the glossary of one text, Hubbard and O'Brien.

Table 3: Coverage of topics in glossary

Authors	Institutions	Private Property	Property Rights	Rule of Law
Baumol & Blinder			X	
Case et al.				
Colander	X	X	X	
Cowen & Tabarrok	X			
Frank & Bernanke				
Gwartney et al.	X	X	X	
Hubbard & O'Brien			X	X
Krugman & Wells			X	
Mankiw			X	
McConnell et al		X		
McEachern	X	X	X	
Miller		X	X	

Moving to the index we see that textbooks present these ideas more frequently, but the references associated with these terms vary greatly. For instance, while eleven of the twelve textbooks include property rights in their index, only four directly link property rights to economic growth and only two of the seven texts refer specifically to the importance of legally protecting private property. Regarding institutions, only six texts have a mention of institutions in their index, however one of these lists institutions only in a financial context. The remaining five refer variously to institutions that support markets, or being related to economic growth, and investment. Tables 3 and 4 note the coverage of these topics in their glossaries and indexes. The implication however, is that texts as a whole do not place much emphasis on institutions whether we are counting pages or looking up the term in the index.

Table 4: Coverage of topics in index

Authors	Institutions	Private Property	Property Rights	Rule of Law
Baumol & Blinder			X	
Case et al.	X	X		
Colander	X		X	
Cowen & Tabarrok	X		X	
Frank & Bernanke		X	X	
Gwartney et al.	X	X	X	X
Hubbard & O'Brien		X	X	X
Krugman & Wells	financial institutions only		X	
Mankiw			X	
McConnell et al		X	X	
McEachern		X	X	
Miller	X	X	X	

Conclusions

This paper has attempted to add to the literature reviewing how college textbooks cover material. Using the Council for Economic Education's *Voluntary National Content Standards* as a guide, we have illustrated that the vast majority of textbooks place a significantly larger emphasis on discussing market failure than they do government failure, or even the role of institutions such as private property and the rule of law in promoting economic well being. This can cause a false impression on two fronts. First it leaves students with the impression that markets are prone to fail on their own and that government policy can fix these shortcomings rather than exacerbate them.

Secondly, by not emphasizing the protective role of government in terms of property rights texts fail to highlight what government should be doing to promote economic growth and stability leaving the reader with the belief that regulation of the market to stave off market failures is the most effective tool of government.

We believe that a more balanced approach is in order for textbooks to provide an accurate view of the role government should play in a vibrant economy. This could be achieved by emphasizing the importance of property rights, and government's role in protecting these, and the lack of clearly established property rights in the case of market failures. Additionally, textbooks should spend more time identifying the unintended consequences of government involvement in the markets by discussing topics like moral hazard in the context of government policy.

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Using Twitter to Improve Student Writing

Michael Enz and Alice Lousie Kassens

Abstract

The economics pedagogy literature concerning the use of social media in the classroom is rapidly growing. This paper adds to the literature by providing initial evidence of the potential impact of using Twitter to improve writing about economics. Writing assignments before and after a series of Twitter assignments coupled with prompt feedback are utilized. A Principles of Macroeconomics course and two sections of an Intermediate Microeconomics course from two different institutions are used in the analysis.

Introduction

A recent area of growth in the economics pedagogy literature pertains to the use of social media. Many articles are descriptive; a few provide evidence supporting the benefits of social media use in the economics classroom. The robustness of the published evidence varies considerably. Previous studies from other disciplines mention the writing benefits of using Twitter (Dunlap & Lowenthal, 2009) and one attempts to measure the benefit in terms of examining the overall grade in the course with two groups of students (Davis & L. Roger, 2011). This paper provides initial evidence of the potential impact of using Twitter to improve writing and learning about economics by scoring writing assignments before and after a series of Twitter assignments coupled with prompt feedback.

Literature

A considerable literature exists describing uses for Twitter in the classroom and the resulting impact on engagement, participation, success, writing and communication skills, community, learning, and memory. Several studies suggest that Twitter activities throughout the semester improved student mood, engagement, and success, particularly if the assignment was a considerable share of the course grade and faculty participation was strong (Ebner, Lienhardt, Rohs, & Meyer, 2010; Elavsky, Mislan, & Elavsky, 2011; Junco, Elavsky, & Heiberger, Putting twitter to the test: Assessing outcomes for student engagement and success, 2012; Junco, Heiberger, & Loken, The effect of Twitter on college student engagement and grades, 2011; Rankin, 2009). The utility is particularly helpful promoting discussion in large classes and amongst students reluctant to speak in class. One study found no significant effect of Twitter on engagement, but the assignments were low stakes (Welch & Bonnan-White, 2012). Frequent tweets of course concepts also improve concept retention and success (Blessing, Blessing, & Fleck, 2012; Wang, 2013). Davis and Yin (2011) recognize the importance of developing writing and familiarity with technology before entering the workforce. The authors combine the two by having some of their students conduct activities using Twitter and find evidence of increased learning for these students by examining the final course grades for students who were forced to use Twitter and those who were not. Dunlap and Lowenthal (2009) use Twitter to enhance a social presence in online courses. In addition to improving the learning environment they note that Twitter has an added benefit of assisting the students in writing concisely and writing to a particular audience.

The 140 character limit forces tweets to be succinct. Journalists refer to Twitter as an "electronic editor" (Tenore, 2012). The brevity of tweets can also be a powerful tool for teaching and practicing writing and other communication skills (Helvie-Mason, 2011). The character limit also forces writers to broaden their vocabulary (Blanchard). Based on survey results, students believe the Twitter character limit encourages concise and clear writing (Davis & L. Roger, 2011).

Several decades ago, economists spoke of integrating writing across the curriculum to improve undergraduate writing, thinking, and arguing skills and link course material (Cohen & Spencer, 1993; Seigfried, et al., 1991). Writing about economics is a vital test of student understanding of course material,

but is a challenge in an introductory course where student writing skills are often poor or in intermediate level courses where time is particularly limited. A Twitter assignment pushes students to edit and develop concise arguments and does so in a manner that is easier and faster for the instructor to evaluate than a longer writing assignment[35].

Kassens outlines a semester-long project employing Twitter to improve several skills including undergraduate writing in a Principles of Macroeconomics class (Kassens, 2014). Students responded to ten prompts throughout the semester, each graded with a common rubric. The rubric covered two dimensions: content and requirements. "Content" included the specificity and clarity of the tweet while "Requirements" addressed submission deadlines and proper hashtag use. Scores for both areas followed a general upward trend throughout the semester suggesting Twitter as an instrument to improve student writing. The sample size for the study is small (N=25) and only includes one lower level course. We advance Kassens' study in four ways: 1) including a larger sample size of undergraduate economics students, 2) including a range of courses (lower and upper level), 3) including more than one institution, and 4) adjusting the grading rubric to better identify quality writing.

Sample

One author's sample includes students from two Intermediate Microeconomic Theory courses (N=53) at a public school in Massachusetts with approximately 4,500 undergraduate and 2,000 graduate students. At the time of the sample, prerequisites include Principles of Microeconomics and Principles of Macroeconomics and the course is required for both Economics and Business Administration Majors. Given the relative size of the majors at the school, the classes are primarily Business Administration Majors. The students in the two classes range from sophomore to senior status.

The other author's sample includes students from one Principles of Macroeconomics course (N=24) at a small liberal arts college in Virginia enrolling close to 2,000 undergraduate students. There are no prerequisites for the course and it is required for both Economics and Business Administration Majors. Like the other institution in the sample, Business Administration students outnumber those from other majors. The students in the course range from freshman to senior status.

Assignment

A writing assignment at the start of the semester determines baseline writing ability for students at both institutions. The topics differ between the micro- and macroeconomics courses, but are consistent between the two microeconomics courses. The writing assignment in the intermediate course is a part of the class participation grade (10% of the total course grade), while the assignment in the macroeconomics course is not graded (participation is not a part of the course assessment) but students are told the professor will use it to determine writing ability. Assignments at both institutions are a minimum of 500 words. The writing assignment is scored in both courses using a rubric particular to this research project. The intermediate course repeats the writing assignment in the last week of class to gauge improvement in student writing and student learning. Students in the principles course wrote a 500-word blog post based on a professor prompt in the latter part of the semester. The assignment is graded and worth 5% of the course grade. Faculty involved in the project attempted to modify the classes as little as possible for the research project, hence the differing writing assignments. Repeating the first week writing assignment in the Principles of Macroeconomics course would add more assignments than time would allow. The differences in these writing assignments is not for experimental purposes rather consequences of following syllabi submitted prior the decision to undertake this research project.

Both courses require ten tweets based upon prompts from the professor. Sample prompts are shown in Appendix 1. Each professor developed a unique hashtag for his/her courses which students are required to include in each tweet. The process of creating these tweets and the impact on student writing in economics

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[35] The following papers discuss using Twitter in the economics classroom, but are not relevant to this paper: Al-Bahrani and Patel. 2015. Incorporating Twitter, Instagram and Facebook in the Economics Classroom. Journal of Economic Education. 46 (1) (2015), pp. 56–67; Al-Bahrani, A., Patel, D., Sheridan, B.,Engaging Students Using Social Media: The Students' Perspective, International Review of Economics Education (2015), http://dx.doi.org/10.1016/j.iree.2015.06.001; Kader, Ahmad A., Using Twitter to More Actively Engage Students in the Learning Process (June 20, 2012). Available at SSRN: http://ssrn.com/abstract=2091353

are the heart of this research project. Each tweet is graded using the rubric shown in Figure 1 and account for 1% of the course grade (10% total). Professors share tweets with students in class and offer prompt feedback. Common advice to students included 1) clarification or corrections to economic theory, 2) encouraging more detail and clarity, and 3) not wasting characters with quotations. The purpose of these short, graded writing bursts is to improve student writing and comprehension of course content in an efficient manner for both the students and faculty. Improvement in the pre- and post-writing assignments suggests improved student writing and learning. Details of the complete assignment are shown in Table 1.

Table 1. Assignment Summary

		Intermediate Microeconomics	Principles of Macroeconomics
Baseline writing assignment		Yes	Yes
	Graded?	Yes, share of participation grade	No
Semester Tweets		Yes	Yes
	Number	10	10
	Graded?	Yes, 1 percent each	Yes, 1 percent each
End-of-semester writing assignment		Yes	Yes
	Graded?	Yes, share of participation grade	Yes, 5 percent
Number of students		53	24

Rubric

Two rubrics are used in this analysis. The first is a modified version of Kassens' rubric which is used to score the pre- and post-writing assignments (Kassens, 2014) and is shown in Table 2.

Table 2. Rubric

	5	4	3	2	1
Critical thinking	Demonstrates a clear, thoughtful, well-reasoned, developed, and persuasive argument				No position is clearly taken
Language	Uses sophisticated, appropriate language which is precise and suitable for the audience; strong sentence structure				Uses language that is unsuitable for the audience and assignment; severe sentence structure issues
Economic Theory	Carefully and accurately uses economic theory to build argument(s) and interpret results				No use of economic theory

The modifications permit a better assessment of writing quality, the focus of this analysis. Student pre- and post-writing assignments are scored on three elements: 1) critical thinking, 2) language, and 3)

economic theory. The critical thinking element addresses student ability to develop a clear and persuasive argument. The language component covers the precision, quality, and suitability of the writing. The third element, economic theory, addresses the accuracy of the economic theory in the argument. Scores over the semester for the critical thinking and language elements assess improvements in student writing while those for the economic theory element measure the level of student learning. Kassens' 2014 rubric is used to score the ten Twitter assignments scattered throughout the semester.

Findings

The graded results of the pre- and post-writing assignments are shown in Table 3; only students completing both writing assignments are included in the analysis. After the initial writing assignment in the intermediate course, the average score for Critical Thinking is 3.43, the average score for Language is 3.14, and the average for Economic Theory is 3.35. At the end of the course when the same writing assignment is repeated, the average score for Critical Thinking is 3.84 (an increase of 0.41), the average score for Language is 3.61 (an increase of 0.47), and the average score for Economic Theory is 3.80 (an increase of 0.45). For Critical Thinking, 24 students (49%) increased their score, 20 students (41%) scored the same, and 5 (10%) students decreased their score. For Language, 27 (55%) students increased their score, 18 students (37%) scored the same, and 4 students (7%) decreased their score. For Economic Theory, 22 students (45%) increased their score, 24 students (49%) scored the same, and 3 students (6%) decreased their score.

Table 3. Pre- and Post-Writing Assignments

Pre		Principles	Intermediate	Difference
	CT	2.9	3.4	0.5*
	LAN	3.5	3.1	-0.4
	ECON	2.9	3.4	0.5
Post				
	CT	3.2	3.8	0.6**
	LAN	3.6	3.6	0.0
	ECON	3.2	3.8	0.6**
Difference				
	CT	0.3	0.4***	0.1
	LAN	0.1	0.5***	0.4
	ECON	0.3	0.5***	0.1
Percent with improvement				
	CT	0.44	0.49	0.05
	LAN	0.28	0.55	0.27
	ECON	0.45	0.45	0.00
N		*18*	*49*	

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Principles students performed less well than intermediate students for most rubric elements on both the pre- and post-writing assignments. On the initial assignment, students averaged a 2.9 on the Critical Thinking and Economic Theory elements; they averaged a 3.5 on the Language element. At the end of the semester all scores improved, particularly for Critical Thinking (3.2) and Economic Theory (3.2). The

Language score improved modestly to 3.6. Close to 45% of students in principles improved their Critical Thinking and Economic Theory scores, while 28% improved their Language scores.

If students improve in their writing and learning of economics throughout the semester, then the scores for Critical Thinking, Language, and Economic Theory should increase. Table 2 shows that there is an increase in scores in all three categories for both the principles and intermediate level courses. These results should not be mistaken for results that were conducted using a natural experiment nor results that are robust empirical evidence. The results should be interpreted as being consistent with student writing and learning in economics increasing in a semester when the students were asked to hone their writing and analysis skills using Twitter assignments. A natural experiment would involve subjecting some classes to the Twitter assignments and other classes conducted in the same manner minus the Twitter assignments. It should be noted that the data are subject to potential bias given the authors graded assignments from their own classes. The evidence in Table 2 fails to dismiss the possibility that students' economic writing naturally increases during any given semester with an economic course. Additional research using the same pre- and post-writing assignments without Twitter assignments could answer this theoretical possibility. Even without answering all of the potential explanations, the data in Table 2 are consistent with expected results if using Twitter assignments increases students' economic writing.

Conclusion

The results of the pre- and post-writing assignments are consistent with evidence that using Twitter assignments can increase economic writing and learning. Students in the intermediate courses earned statistically significant higher scores in the areas of critical thinking, language, and economic theory. Students in the principles course increased their average scores in the areas of critical thinking, language, and economic theory. Additional research is needed to determine if the Twitter assignments directly caused the scores to increase, however the initial data are consistent with the outcomes of improved economic writing and learning.

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Appendix 1. Sample prompts

Sample 1: Use the economic principle of comparative advantage to argue in favor of a volunteer military over conscription.

Sample 2: Read the article found here: http://libertystreeteconomics.newyorkfed.org/2011/06/commodity-prices-and-the-mistake-of-1937-would-modern-economists-make-the-same-mistake.html
What was the mistake of 1937?

Sample 3: Review the photo found here: http://gregmankiw.blogspot.com/2011/10/monetary-system-of-future.html
What kind of monetary system would satisfy these demands? Your tweet should be clear to people who have not read the question.

The Influence that Time Costs and Money Costs Have on Work Incentives: An Application of Childcare Subsidies

Laura A. Boyd[1]

ABSTRACT

When deriving an individual's labor supply curve, most labor economics textbooks ignore any monetary or time costs associated with working. However, students realize that this assumption is not realistic, particularly for working parents who have children in daycare. The author presents an analysis of how both monetary and time costs associated with working influences an individual's reservation wage. Additionally the author compares how the aggregate supply of hours offered within a firm is influenced by that firm adopting a childcare subsidy benefit that either reduces the monetary costs or time costs associated with have a child in daycare.

Introduction

Today as more children live in households in which all resident parents are working[2], firms have to consider the work incentives that are created by their employment benefits and policies. One benefit a firm could provide is a subsidy to help alleviate the associated daycare costs for employees with young children. The provision of childcare assistance clearly would enhance the outcome of the working parent, but the firm also stands to gain if employees choose to work more hours. Whether a worker decides to work more or fewer hours for the firm depends upon how childcare costs are subsidized.

The typical undergraduate labor economics textbook may briefly mention the influence that either fixed monetary costs or time costs associated with working have on an individual's labor supply[3]. However, most students realize that the simplifying assumptions about monetary and time costs being nonexistent when deriving the labor supply curve do not reflect the realities associated with working. Moreover, the analyses associated with an individual experiencing a positive work-cost, either monetarily or terms of lost time, are not analogous to simply reducing nonlabor income or available discretionary time of the individual. Using the practical application of childcare costs, this paper provides an instructional extension to the derivation of an individual's labor supply curve. An analysis on how relaxing these zero work-cost assumptions influences the labor supply and the theoretical implications to an employment scenario in which a firm subsidizes the daycare costs for employees with young children are presented.

The paper proceeds as follows. In the following section, a graphical analysis and discussion of monetary and time costs of an individual's labor supply, building upon the standard labor-leisure diagram, are developed. The next section of the paper presents an application in which a firm influences the work incentives of its employees with young children by reducing either the monetary or time costs associated with having children in daycare. The final section includes a summary of the graphical analytics of three

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[2] In 2012, 59% of married-couple households with children had both parents working. For households without a spouse present, 67% of the mothers in female-headed homes were working and 82% of fathers were employed in male-headed households (*Employment Characteristics of Families – 2012*, Bureau of Labor Statistics (2013)).

[3] Ehrenberg and Smith (2015) do discuss the influence that time costs have on the reservation wage without analyzing the effect on hours of work for those in the labor force. They also discuss the influence that reducing monetary costs has on labor force participation and on work hours for those in the labor force but do not discuss how the reservation wage is impacted.

childcare policies and identifies that only the policy that provides on-site childcare is best for both working parents and the firm.

Monetary and Time Costs

No Costs

When deriving an individual's labor supply curve, the typical labor economics textbook assumes that the individual has T discretionary hours available per week to either spend working or in leisure activities after subtracting out only the time used for required sleeping, eating, and personal care[4]. Moreover, while it is often assumed that an individual has V dollars available for weekly consumption that is derived in some nonlabor manner (interest, dividends, alimony, defined pension, etc.), the general assumption is that there is neither time costs (which would reduce the available discretionary hours, *if the individual works*) nor fixed monetary costs (which would reduce the nonlabor income available, *if the individual works*) associated with working. In the labor-leisure diagram in Figure 1, an individual who does not work is endowed with T hours in leisure time and V dollars in consumable goods. This endowment point, A, is important in determining a worker's reservation wage – the wage rate in which an individual is indifferent between working and not working. Given an individual's value of leisure time as reflected by the shape of the indifference curve IC1 in the figure, the absolute value of the slope of the indifference curve going through point A reflects the individual's reservation wage (as shown by the absolute value of the slope of the dashed line at point A that is tangent to IC1). Given a market wage rate reflected by the slope of the budget constraint AB in the figure, this individual would choose to work T – LE1 hours since a higher level of utility could be achieved at point C on indifference curve IC2. Comparing absolute values, the slope of budget constraint AB is indeed steeper than the slope of IC1 at endowment point A, implying that the market wage is greater than the reservation wage and higher utility is achieved from working.

Figure 1: Optimal Hours of Work and the Reservation Wage

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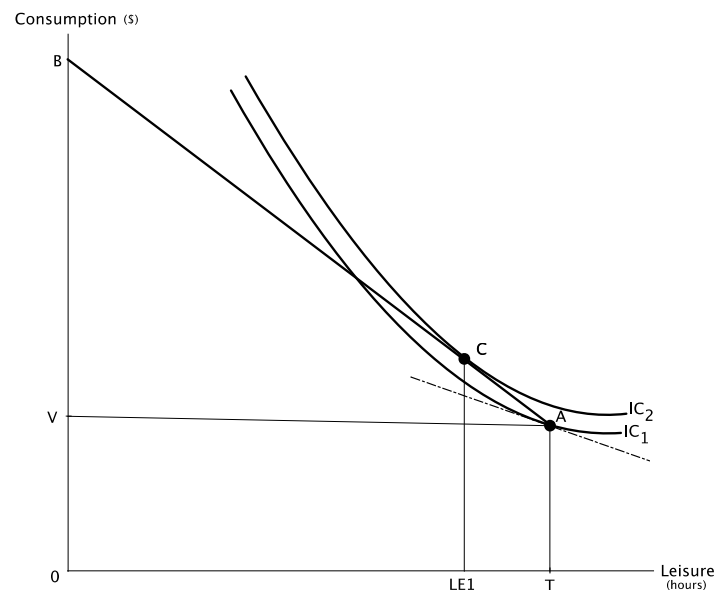
[4] Although the analyses outlined in this paper are fundamentally derived from Gary Becker's (1965) "A Theory of the Allocation of Time", this paper adopts the typical undergraduate labor textbook's definition of time as being the sum of non-discretionary time (time spent eating, sleeping, and in personal care/grooming) and discretionary time (paid market work and all other activities – leisure – which includes commuting to and from work) in order to derive an individual's labor supply curve.

The typical labor textbook discusses how a change in both nonlabor income and the market wage rate influences the individuals labor supply while holding preferences for work and leisure constant. Reducing nonlabor income from V dollars to V2 dollars in Figure 2a has only an income effect on the demand for leisure. That is, with the wage rate held constant and the new endowment point falling to point D in the Figure 2a, the individual's budget constraint becomes DE such that the hours of work increases to T- LE2, assuming that both leisure time and consumption goods are normal goods[5].

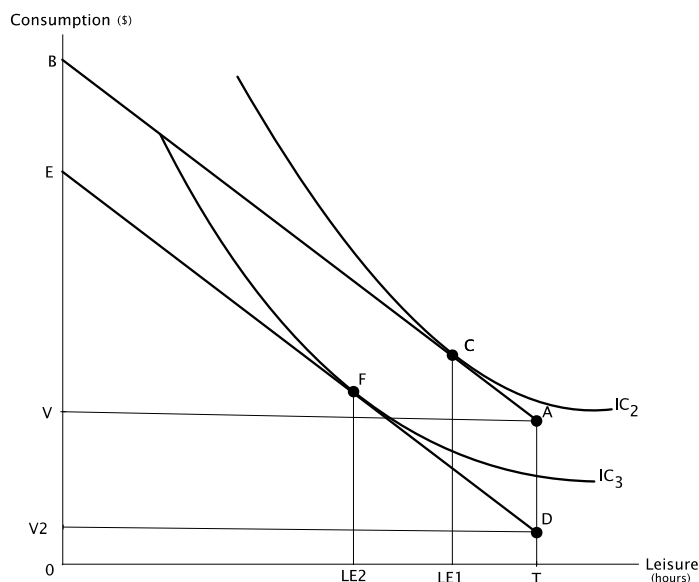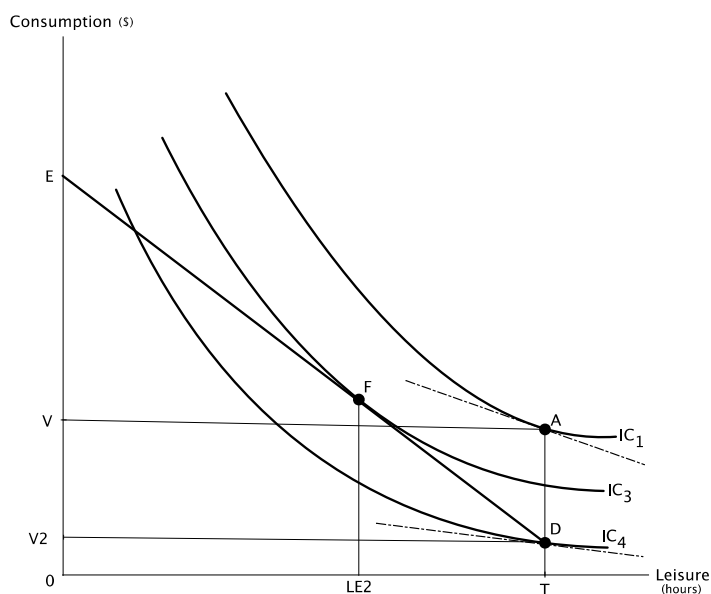**Figure 2a: Impact of a Decrease in Nonlabor Income on Work Hours**

**Figure 2b: Impact of a Decrease in Nonlabor Income on the Reservation Wage**

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[5] Most prominent labor textbooks assume leisure is a normal good when discussing how a change in nonlabor income influences work hours. Only Borjas (2015) includes a discussion about whether leisure could legitimately be an inferior good.

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Moreover, the reservation wage has decreased. In Figure 2b, the absolute value of the slope of the tangent line to indifference curve IC4 at the new endowment point D is flatter than that at point A along IC1. The individual now, with less nonlabor income, is willing to work at wages that previously he/she would have been unwilling. Working T – LE2 hours per week is the optimal choice for this individual since the market wage, reflected by the absolute value of the slope of budget constrain DE, is greater than the reservation wage.

A change in the market wage rate, which changes the slope of the budget constraint, has no effect on the individual's reservation wage because the endowment point remains at point A. With a decrease in the market wage, the individual will continue to work as long as the slope of the new budget constraint given by AG in Figure 3 is greater than the reservation wage which is still the absolute value of the slope of IC1 at endowment point A (as shown in Figure 1). Whether the individual works more or fewer hours than T – LE1, is theoretically ambiguous. Most labor economic textbooks do a good job at dissecting the analysis between the substitution and income effects associated with a wage change. For some individuals who have high values of leisure time, the income effect dominates the substitution effect and the individual will work more with the wage decrease. For others who value consumable goods more highly, as shown by the individual's preferences as reflected in Figure 3, the substitution effect will dominate the income effect such that the individual works fewer (T – LE3) hours. However, we know that unambiguously as the market wage continues to decrease, at some point it will fall below the reservation wage and the individual will choose to drop out of the labor force, and locate at endowment point A along IC1.

Figure 3: Impact of a Decrease in Wage Rate on Work Hours
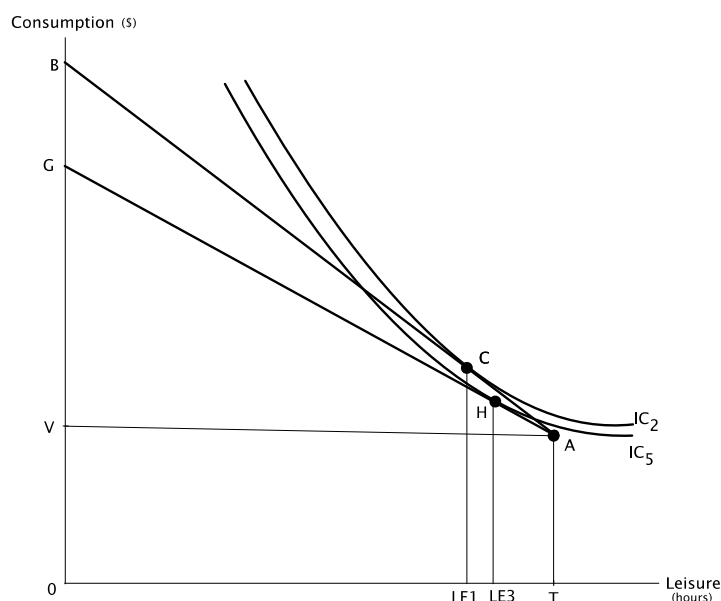
Monetary Costs

If an individual chooses to work, there are often out of pocket monetary costs associated with working. Assuming that these costs are fixed per week then only if the individual does work, the available nonlabor income is reduced by the amount of these fixed costs. Figure 4a depicts the labor-leisure optimization for an individual who incurs fixed monetary costs associated with work. If the costs are a fixed amount of X1, the budget constraint emanates from point J1, but this point is not part of the budget constraint and is reflected by an open-ended budget constraint. That is, if the individual chooses not to work, then the endowment point remains point A. Like the reduction in nonlabor income, incurring monetary costs with working causes the budget constraint to shift parallel and inward toward the origin. If the individual remains in the labor force, he will work more hours (T – LE4). Logically, if monetary costs associated with

working increase dramatically to X2, then the individual would be best off not working, as reflected by IC1 being further from the origin that IC7, as shown in Figure 4b. The theoretical reason for why this happens is that the reservation wage increases as monetary costs of working increases.

Figure 4a: Impact of an Increase in Monetary Costs on Work Hours
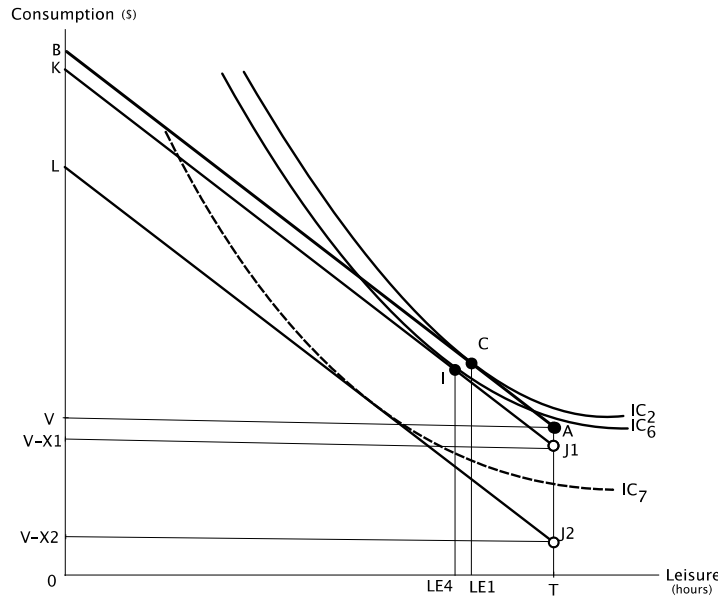
Figure 4b: Impact of an Increase in Monetary Costs on the Reservation Wage
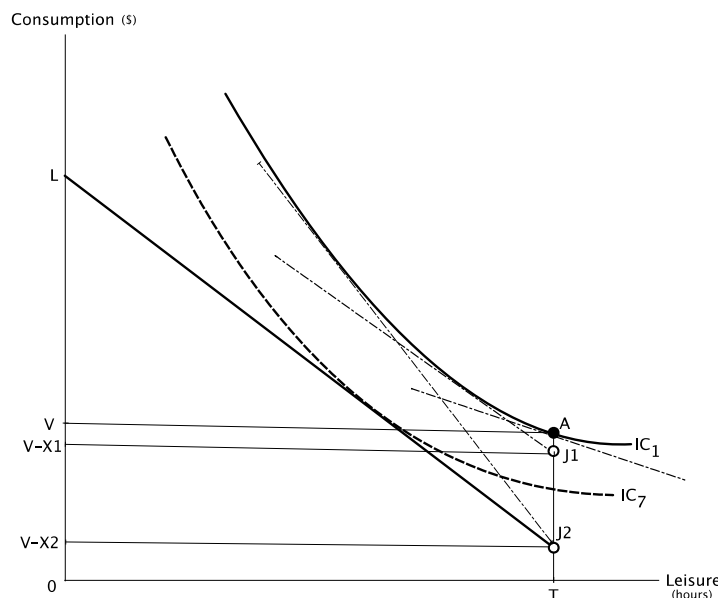
This can be seen in Figure 4b by analyzing the absolute value of the slope of a hypothetical budget constraint that includes the monetary costs of working. If the individual does not work, IC1 reflects this preference. Moreover, if the individual does work, the budget constraint begins at point J1, when monetary costs are X1, and at point J2 when the costs are even greater (X2). The absolute value of the slope of the dashed budget constraint that is tangent to IC1 and that emanates from the point that includes the monetary costs if the individual works reflects the reservation wage. Comparing the reservation wage when the

worker experiences X1 dollars in fixed costs associated with working (using the hypothetical budget constraint originating at point J1) to the reservation wage when there are no monetary costs (the absolute value of the slope IC1 at point A), we find the reservation wage has increased and continues to increase as the monetary costs rises to X2. The absolute value of the slope of the budget constraint that reflects an individual being indifferent between working and not working becomes steeper as the monetary costs associated with working rise and, at some point, will exceed the market wage, such that the individual's optimal choice will be not to work – locate at point A on IC1.

Time Costs

Like monetary costs, if an individual chooses to work, one must allow for the time it takes to commute to and from work. This commute time is no longer available to spend in leisure activities nor is included as paid working time. If the individual works, and experiences Y1 hours per week in commute time, the budget constraint will emanate from point M1 in Figure 5a. Also, analogous to monetary costs, this budget constraint is open-ended because if the individual chooses to not to work, then the endowment point remains point A. As commute time increases, the budget constraint moves in toward the origin parallel, and, assuming both leisure and consumption goods are normal goods, leisure time falls. But that does not necessarily imply that work time rises. In fact, as shown in Figure 5a, as commute time increases from 0 hours to Y1 hours per week, work has decreased from T – LE1 to (T – Y1) – LE5. In Figure 5a, one can see that the difference between the hours of leisure time is less than the total commute time (LE1 – LE5 < Y1). If only part of the commute time comes from a reduction in leisure hours, the remaining time must come from reducing hours of work. Unlike an increase in monetary costs, an increase in time costs associated with working will cause hours of work to decrease.

Figure 5a: Impact of an Increase in Time Costs on Work Hours
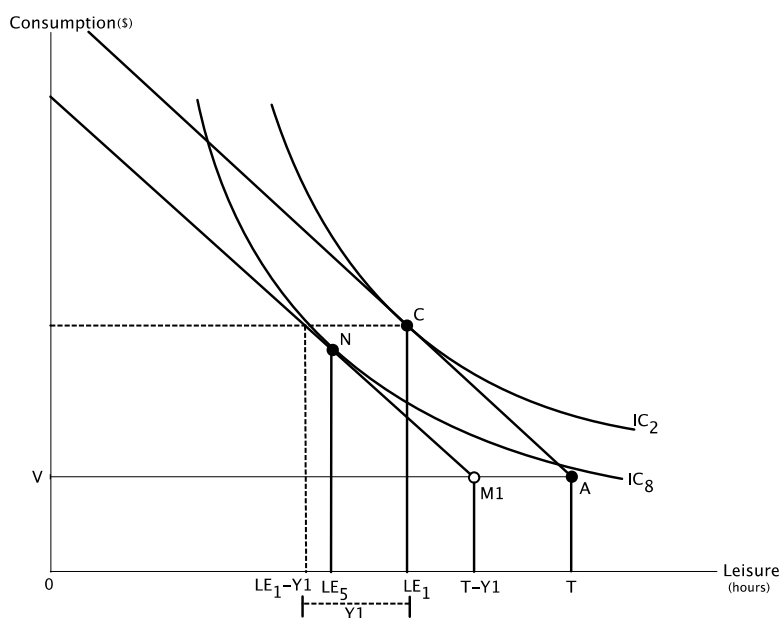
However, analogous to rising monetary costs, if time costs increase dramatically to Y2, then the individual would be best off not working, as reflected by IC1 being further from the origin that IC9 in Figure 5b. It is found that the reservation wage increases as time costs of working increases. To see this, we can compare the reservation wage for a worker who has zero time costs associated with working and one who has Y1 hours in time costs. Again, the absolute value of the slope of a hypothetical budget constraint at point A reflects the reservation wage of the individual who experiences no time costs. Whereas the absolute value of the slope of the budget constraint that begins at point M1 and tangent to the indifference

curve IC1 reflects the reservation wage of the individual who experiences Y1 hours of time costs associated with working. The dashed budget constraint emanating from M1, in Figure 5b is steeper, in absolute value, than the slope of IC1 at point A. As time costs increase further to Y2, the reservation wage will continue to rise. Logically, at some point the time costs associated with working will become so great that the reservation wage will exceed the market wage and the individual will be best off not working – locate at the original endowment point A on IC1.

Figure 5b: Impact of an Increase in Time Cost on the Reservation Wage
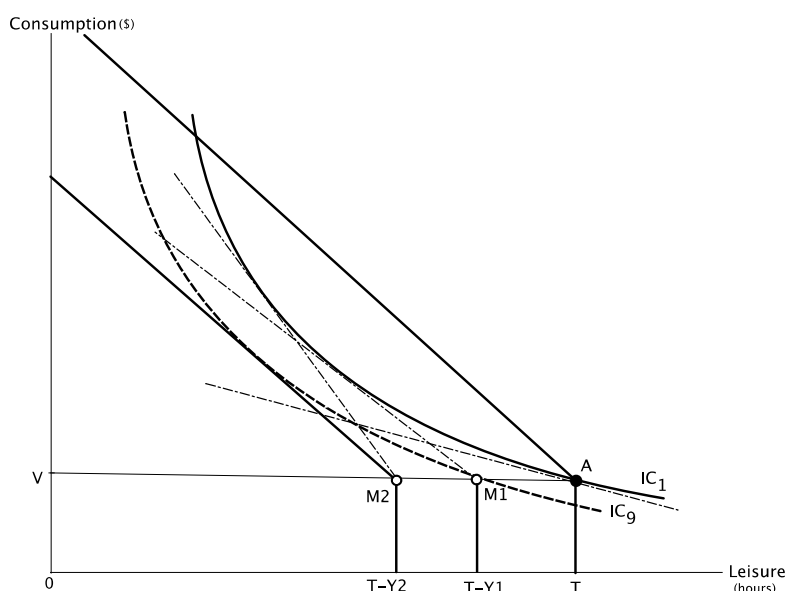
Application: Subsidizing Childcare Costs

As shown in the preceding section in Figures 4b and 5b, increasing either the monetary or time cost associated with working will increase the individual's reservation wage. With substantial increases in either monetary or time costs, the reservation wage will exceed the market wage and the individual will choose to leave the labor market. However, for those individuals who remain in the labor force, an increase in monetary costs will increase hours of work whereas an increase in time cost will decrease hours of work. Using these results, we can analyze the outcomes of various policies that an employer might adopt to help alleviate childcare costs for working parents. Presumably, there are both monetary and time costs associated with having young children in daycare while working. That is, parents have to pay a daycare provider for their services, which typically are weekly fees, and also have to factor in the time it takes to transport the child to and from the facility site. An employer trying to attract working parents might adopt a policy in which either time or money costs associated with daycare are subsidized[6]. When trying to choose between policies that would not only benefit the working parent but also the firm, from a labor-supply perspective[7], only subsidizing time costs by providing on-site childcare facilities unambiguously makes both parties better off.

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[6] According to a Bureau of Labor Statistics study, in 2014, ten percent of private sector workers had access to childcare facilities provided by employers and 36% had access to employer-sponsored dependent care reimbursements. (*National Compensation Survey: Employee Benefits in the United States*, *March 2014*, Bureau of Labor Statistics (2014), Tables 40 and 41.)

[7] Each of these policies have labor demand ramifications in that they add to the costs of hiring workers. Moreover, the costs of each program are not likely to be equal. Yet, at the same time, the policies are likely to have differing productivity benefits, such as fewer days of employee absences or reduced turnover. The implications that these policies have on both the costs and productivity of workers is one way the discussion of workplace childcare benefits could be extended.

The literature on the effects that childcare has on labor supply is largely empirical using historical data from government subsidized programs, although Heckman (1974) does provide a graphical analysis of publically subsidized childcare[8]. The focus is on how various programs, whether they are grants, tax credits, or publically-funded schooling, influence the labor force participation rate of primarily low-income women with young children. Blau and Robins (1988), Anderson and Levine (2000), Lefebvre and Merrigan (2008), and Bauernschuster and Schlotter (2015) find that subsidized daycare programs modestly increase the employment of mothers. Although most subsidized childcare has historically been government provided, as the federal government seeks ways to reduce overall costs and as firms seek a more diverse workplace, alleviating childcare constraints is likely to become a more relevant issue that firms will take on privately. The most effective childcare policy would not only increase the labor force participation rate of parents with young children but also increase the hours of work from current workers.

Assume that a firm could potentially adopt one of three different policies that reduces either the monetary costs or time costs associated with employees having young children in daycare. Policy I provides a weekly grant of $X1; Policy II imparts a grant of $Z per hour for each hour the employee is working; Policy III would provide on-site day care facilities which reduces commute time by Y1 hours. The first two policies help defray the monetary cost of having a child in daycare whereas the third policy reduces the time costs associated with transporting the child to and from a daycare facility. To analyze each policy individually, the graphical analyses provided in the preceding section can be employed.

Policy I: Weekly Grant of $X1

Policy I effectively reduces the monetary costs of working by $X1 per week. Using Figure 4a, we can see it would have the effect of shifting the individual's budget constraint outward and parallel. Thus, for that employee, the hours of work will unambiguously decrease. However, adopting Policy I might attract new working parents to the firm since a reduction in monetary costs reduces the reservation wage of the worker, as shown in Figure 4b[9]. The aggregate effect on hours of work within the firm cannot be theoretically determined. For those already employed, they will work fewer hours; however, new employees offering a positive amount of hours will be attracted to the firm.

Policy II: Hourly Grant of $Z

Likewise, Policy II has an indeterminate effect on the total hours of labor supplied by workers since the policy effectively increases the worker's "take-home" wage by $Z per hour. As discussed with Figure 3, an increase in the wage rate has a theoretically ambiguous effect for any one individual. For those with a dominant income effect, work hours will fall. However, if the substitution effect dominates, work hours increase. Like Policy I, this policy could attract new working parents to the firm since the subsidy has the effect of potentially increasing the effective "take-home" wage above the reservation wage for some workers previously not in the labor force. Again, the aggregate effect of Policy II on employees' hours of work is theoretically indeterminate.

Policy III: Providing On-Site Daycare

Only Policy III has the unambiguous effect of increasing hours of work for parents with daycare-aged children. The provision of an on-site facility would eliminate the time it takes to transport the child to and from daycare which effectively reduces the time costs associated with working. As shown in Figure 5a, a reduction in time costs by Y1 hours per week will increase the hours of work for those individuals in the labor force. Moreover, as shown in Figure 5b, providing an on-site daycare facility reduces the reservation

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[8] He theorizes that the availability of government-subsidized childcare changes the reservation wage of a typical worker with young children. Not only will the budget constraint shift out but also the indifference curve becomes flatter as the type of care shifts from low-quality informal care to high-quality market care.

[9] Unlike Heckman's (1974) assumption about the quality of care varying whether it is provided formally in the market or informally and hence the reservation wage will be influenced directly by the value of leisure time, this paper assumes static preferences. Therefore the reservation wage will only be affected by the budget constraint and not by the steepness of the indifference curve.

wage such that some parents, previously not in the labor force, would chose to work for this firm. Only Policy III has the unambiguous effect of increasing work hours from parents currently working for the firm as well as from parents previously not in the labor force but now offering a positive amount of hours of work to this firm.

Summary

Childcare benefits to workers are a relevant extension of the basic derivation of the individual labor supply curve that is presented in undergraduate labor economics courses. Although not common, some labor texts do extend the basic model to include both time and monetary costs of working[10]. The type of childcare benefit, whether it influences the out-of-pocket monetary cost of providing childcare or it influences overall discretionary time, has differing outcomes than both an increase in available nonlabor income and discretionary time. Moreover, this paper shows that only subsidizing time costs by providing an on-site childcare facility unambiguously makes both working parents with young children and the firms hiring these workers better off.

The general analytics of the childcare policies for those who are in the labor force – working a positive amount of hours – is the same as reducing monetary and time costs associated with working. Subsidizing the monetary costs of daycare through a fixed grant amount per week to working parents unambiguously decreases hours of work. Likewise, reducing the time costs by providing on-site daycare unambiguously increases hours of work. However, for those parents not in the labor force, the theoretical result that each daycare policy has differs from an increase in nonlabor income or available discretionary time. Both an increase in available nonlabor income and decrease in monetary costs associated with working can be shown in a labor-leisure diagram as shifting the individual's budget constraint away from the origin; the former has the effect of increasing the reservation wage whereas the latter decreases the reservation wage. That is, a firm providing a grant to working parents is likely to attract new workers who have relatively high reservation wages and hence aren't in the labor force since it has the effect of reducing the reservation wage. Likewise, a decrease in commute time associated with working will shift the budget constraint further from the origin. This decrease in time costs associated with working also will decrease the reservation wage and hence entice parents to enter the labor force. At the margin, both reducing monetary costs and time costs have the effect of increasing labor force participation, and hence work hours, from individuals previously not working.

Today, when roughly half of all households in the U.S. with children under six years of age have a parent who is in the labor force[11], firms are becoming more attentive to these parents' needs. From a labor supply perspective, for a firm trying to decide on a childcare policy to adopt that would not only benefit its current employees but also increases the hours of work that current employees supply to the firm, providing on-site childcare unambiguously is the clear choice.

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[10] Employing Becker's (1965) model of time allocation could further extend the analysis. Both the monetary childcare benefits and on-site daycare would influence the household's production of all commodities, including children, that enters one's utility function. Therefore, reducing commute time would effectively increase both time-intensive and commodity-intensive consumption and hence influence the reservation wage by not only increasing time but also from decreasing the price of those commodities.

[11] Table 4, Bureau of Labor Statistics (2013).

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What "The Simpsons" Can Teach Us About Sports Economics

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Abstract

This paper provides an insight into the teaching of economics. Using sport and *The Simpsons* one can do some of the heavy lifting when teaching the subject, as these topics generally engage students and provide ample analogies from which one can explore and discuss key economic concepts. The paper does not seek to provide a deep examination of the economics of sport, but merely to illustrate how *The Simpsons* and sport can be used to teach fundamental economic concepts.

Introduction

As the longest running scripted television show in US primetime history, *The Simpsons* permeates popular culture to such an extent that few students enter university without awareness of the show and its characters (Waltonen & Du Vernay, 2010). Ignoring its educational relevance would be the modern equivalent to overlooking the significance of Greek Mythology or the works of Shakespeare. Therefore, it is not surprising to find that there are a variety of books[1] and articles[2] that examine the show from the perspective of a range of academic disciplines. *Homer Economicus: The Simpsons and Economics* is the latest book in this line and, as the subtitle suggests, it examines *The Simpsons* from the perspective of economics. The third part of the edited volume includes a range of chapters documenting how *The Simpsons* can be used to help teach a variety of applied microeconomic topics, e.g. health economics, immigration, casino gambling, and alcohol control. Our paper adds to this literature by illustrating how *The Simpsons* can be used to introduce and teach sports economics.

Both fiction and sport are used as aids in economics education. The use of literary fiction has a respected tradition.[3] In recent years, the representation of a fictional narrative on screen has become more popular in economic education.[4] The economist Dirk Mateer has a website dedicated to the illustration of economic concepts through the use of TV and films clips (including *The Simpsons*). The use of examples from sport to illustrate economic concepts is also widespread as documented by Becker and Watts (1996) in their survey of undergraduate teaching. Mahar and Paul (2010) illustrate how sport can be used to examine topics like opportunity cost, sunk costs, risk and incentives, executive compensation, and measures of performance. Palacios-Huerta (2014) illustrates how both experimental and real-world events from soccer can help economics, its practitioners, and its students. Our paper combines fiction and sport in the form of *The Simpsons*. Specifically, we use fictional sporting examples from the TV show to introduce, motivate, and illustrate concepts in sports economics. Our use of *The Simpsons* to understand concepts from sports economics is not intended to replace the role of a sports economics textbook. Nor do we claim that *The Simpsons* provides useful teaching material for all elements of sports economics. Rather, we examine what *The Simpsons* can teach us about sports economics.

The remainder of the paper is structured as follows. The next section examines the peculiar economics of sport. There follows sections on the demand for sport franchises, the economics of major events, competition and the rules of the game, and sabermetrics. We conclude the paper with a brief summary of our suggestions and provide an appendix that contains a specific guide for teachers seeking to use examples from the show to discuss concepts from sports economics.

The Peculiar Economics of Professional Sport

A little over half a century ago, in one of the first papers in sports economics, Walter Neale drew attention to the dependency between competitors in sports leagues and how it differed from normal

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[1] See Irwin, Conard & Skoble (2001); Brown (2006); Waltonen & Du Vernay (2010); Singh (2013).
[2] See Cantor (1999); Hall (2005); Considine (2006); Fink & Foote (2007); Luccasen & Thomas (2010).
[3] See Watts & Smith (1989; Watts (2002); Watts (2003); O'Donnell (1989); Breit & Elzinga (2002).
[4] Mateer (2005); Mateer & Li (2008); Mateer, Ghent & Stone (2011).

business. Neale titled his paper "The peculiar economics of professional sports". One of the points made by Neale is that sports businesses sell competition and uncertainty of outcome. Few fans will buy tickets to a sporting contest where the outcome is known. Broadcasters battle to secure the rights to live sporting events. The uncertainty of outcome associated with a live screening brings in the viewers. Repeats of sporting events attract only limited audiences.

The importance of uncertainty of outcome is illustrated in "*The Homer They Fall*". Lucius Sweet, the boxing promoter in *The Simpsons*, explains the importance of having some element of competition. Heavyweight champion, Drederick Tatum, is released from prison but Sweet finds it difficult to get an opponent that will provide some resistance for the champion.[5] Sweet declared that "the fans are weary of fights that are over before they have an opportunity to even get drunk. I just need a body who can sustain verticality for three rounds". Fortunately for Sweet, Dr Hibbert diagnoses Homer with a strange medical condition which allows him to sustain blows to the head that do not cause him to be knocked out. Moe Szyslak identifies Homer's condition as an opportunity for him to embark upon a semi-professional boxing career and, under Moe's guidance, Homer starts to box against local hobos. Following an undefeated run, Homer starts to gain recognition as a boxer. It is at this stage Lucius Sweet pays Moe a visit offering Homer a chance to face Tatum. Competition is central to all sport. Spectators pay to watch because there is an element of uncertainty. Homer's arranged fight with Tatum is driven by demand for a fight to last longer than "three rounds".

Walter Neale realised that professional sport is primarily funded by the fans. The governing bodies of sport also realise this fact and they sometimes change the rules to keep the fans interested. For example, in the early 1990s FIFA was worried that the lack of goals in international soccer games might reduce spectator interest in the 1994 World Cup that was due to be held in the USA. Therefore, in 1993 FIFA changed the rules so that teams winning a group stage game would be awarded three points instead of two. The change was not as successful as FIFA anticipated because it incentivised both offensive and defensive strategies.[6] FIFA's belief that an American audience would be bored by the lack of scores is illustrated in "*The Cartridge Family*" where the lack of goals results in a riot.

It is possible to examine rule changes designed to increase fans interest using the Designated Hitter (DH) rule in baseball. The American League (AL) introduced the rule in 1974 on the back of worries about the reduction in runs. Interestingly, the DH rule was not introduced in the National League (NL) and this fact makes it possible for a comparison between the two leagues. The *Wall Street Journal* (2014) presents the following statistics on the differences between the AL and NL.

Table 1: Comparison of American League and National League, 1997-2013

	Win Rate (games)	Slugging %	ERA
American wins at home	57.5 (1,226)	0.445	4.05
National wins in AL Parks	42.5 (906)	0.405	4.86
National wins at home	52.7 (1,123)	0.419	4.08
American wins in NL parks	47.3 (1,009)	0.411	4.27

Notes: Slugging percentage is a weighted batting average that awards more points for extra-base hits (doubles, triples and home runs); ERA, or earned-run average, is the average number of runs in nine innings given up by the pitching staff.

Is the DH rule responsible for all the difference between leagues in Table 1? The *Wall Street Journal* article reported on a statistical model that controlled for the influence of other factors, e.g. the difference in battling prowess between the leagues. The model found that the DH rule improved the AL win rate by two percentage points. However, some baseball fans remain to be convinced that the rule change improves baseball. The debate surrounding the DH rule is captured in "*Them, Robot*" where a robot says "The designated hitter corrupts the purity of an otherwise elegant game. Illogical. Illogical."

There can be a tension between the purity of the game and the fans' desire for rule changes. The DH rule is one such example. At other times, change comes about because of technological advances. In these situations the governing body of the sport will need to decide how much of the technical change is

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[5] Drederick Tatum and Lucius Sweet are based on Mike Tyson and Don King. Former Heavyweight Boxing Champion Tyson suffered from similar competition problems in the early stages of his career with his first sixteen fights all ending before the end of round four.

[6] The unintended consequences of the rule change are examined in strategies Brocas & Carrillo (2004) and del Corral, Prieto-Rodriguez, & Simmons (2010).

acceptable. For example, between 2008 and 2009, over one hundred swimming records were broken because of advances in swimsuits. While the new swimsuits meant that fans could go to swimming competitions with the hope of seeing a record being broken, the governing body intervened to outlaw the swimsuits on the grounds that they damages the integrity of the sport. Another example can be taken from the world of golf. Although not as clear cut, it seems that the introduction of a longer golf putter has improved performance – especially when the player anchors the putter against their body. Again, the governing body of the sport has intervened to outlaw the anchoring of the club this way.

Similar issues arise in relation to the baseball bat. Technological advances mean that it is now possible to produce bats with extra "bounce" or "ping" (the scientific term for the trampoline effect is the Batted Ball Coefficient of Restitution). However, Major League Baseball continues to insist that the bat is made from a solid piece of wood rather than the composite bats now used in Little League. One of the reasons the composite bat is banned relates to health and safety. The composite bat produces greater ball speeds. However, the composite bat may be safer in another way. Bats can break and do damage in the process. In September 2010 Chicago Cubs player Tyler Colvin became a YouTube sensation when he was impaled by a broken bat. The incident reignited the debate on the appropriate type of bat. In 2015, a broken bat injured a female spectator in Fenway Park. There are trade-offs to be made by those in charge of MLB. There are arguments for, and against, composite bats. There are even arguments on the appropriate wood from which to make baseball bats, e.g. ash versus maple.

A discussion of the regulation of baseball can be introduced using *"Homer at Bat"*. In the episode, the Springfield Nuclear Power Plant softball team is led to an undefeated season by Homer and his WonderBat. Homer made his bat from a tree that had been struck by lightning just like the Roy Hobbs (Robert Redford) character in the movie *The Natural*. In an effort to win the title, Mr Burns populates the team with players from MLB. During one practice session, a pitch from Roger Clements breaks Homer's bat. With the exception on Darryl Strawberry none of the MLB players get to play in the decider. With the game in the balance, Homer is introduced as a pinch-hitter for Strawberry. Homer is hit on the head with a pitch resulting in the winning run. The episode can also be used to discuss the rules surrounding substitutions (designated hitter, pinch-hitter, pinch-runner), the regulation of technical change, and even the stockpiling of talent by wealthy owners.

The Market for Sports Franchises

Two of the main sports economics textbooks devote between 15% and 20% of printed pages to the use of public funds on sports facilities (Fort, 2010; Leeds & von Allmen, 2013). These texts examine the subsidisation of sport from the public purse via facility construction for sports franchises. The issues are also examined in *The Simpsons*.

The public subsidisation of sports stadiums and arenas is illustrated in *The Burns and the Bees* (S20:E8). During a game of cards at a billionaires retreat, Mr Burns wins a professional basketball team called the Austin Celtics. Burns promptly moves the team to Springfield and renames them the Springfield Excitement. The franchise moves into a dilapidated arena in a rundown part of town which boasts the "World's Smallest Jumbotron". Following a disastrous start to his ownership and an exodus of fans from the arena, Dallas Mavericks owner Mark Cubin advises Mr Burns to "build a new arena – state of the art". A town meeting is arranged where Lisa Simpson objects to the new arena plans on the grounds it will destroy a local bee sanctuary. Despite Lisa's best efforts, Burns convinces the citizens to build the arena using public money. The arena is built in six weeks! From a public finance perspective, the key line in the episode comes as Mr Burns opens the newly constructed arena and proclaims to an excited crowd "Welcome to the American dream. A billionaire, using public funds, to construct a private playground for the rich and powerful". Mayor Quimby goes further in his description of the arena when he calls it a "decadent momentum to excess".

As *"The Burns and the Bees"* illustrates, team owners and sporting organisations in the United States extract public funding by the strategic use of franchise location. A promise to locate, or a threat to relocate a franchise, concentrates the minds of those controlling the public purse. Since the early 1990s more than 100 sports arenas have been constructed in the United States. The bulk of these projects have received public funding. Long (2012) suggests that the average cost of new stadium projects to the public has risen by nearly 70% over the past decade, with the mean cost at just over $240 million. Despite the public costs, Major League franchises bestow prestige on American cities. Demand for franchises consistently exceeds supply and cities are prepared to incentivise owners to move to their metropolises.

Nalebuff and Brandenburger (1997:39-42) provide detail on a classroom experiment that can be used to illustrate the forces at work. The authors' experiment involves the use of a deck of playing cards. In round one of the game, one person is given all twenty-six of the black cards while twenty-six students get one red card each. A monetary amount is offered for each pair of cards where one is red and one is

black. Results from this experiment shows that the usual outcome is a 50:50 split between each of the red card holders and the black card holder. In round two of the game, the holder of black cards is given only twenty-three black cards. This means three of the red card holders will be left without a matching black card. This increases the bargaining power of the holder of black cards who can subsequently drive a harder bargain. The result is that the black card holder gets more than 50% of the monetary rewards. Nalebuff and Brandenburger use the experiment to explain how the NFL teams like the Cardinal, Rams, and Raiders used the situation to extract resources from cities.

The Economics of Mega Events

Because of the different structure of US and European sports, the (re)location of a franchise is less likely to extract funding from taxpayers in Europe. In Europe, public funding for sports facilities is more likely to be secured by the location of a major sporting event such as the Olympic Games, FIFA World Cup, Rugby World Cup, the UEFA European Championships, or World Athletics Championships. The same forces are at play. It is a situation where the demand for major events exceeds the supply. *The Simpsons* address some of the economics of the Olympic Games and the FIFA World Cup in "*The Old Man and the "C" Student"* and "*You Don't Have to Live Like a Referee"*, respectively.

In "*The Old Man and the "C" Student*" Lisa Simpson writes to the International Olympic Committee (IOC) and asks them to consider Springfield as a potential host city for the Olympic Games. A bickering committee, lobbying for their own countries, cannot agree so the IOC chairman decides they should visit Springfield. During the visit, Chief Wiggum attempts to bribe the IOC representatives with women, guns and drugs. Springfield's bid is not successful because of Bart's unsavoury racist antics in front of the IOC representatives.

Wiggum's attempted bribe of IOC representatives has a real-world counter-part and there is a case to be made that the episode was based on these real world events. "*The Old Man and the "C" Student"* was first aired in April 1999. This was approximately six months after it was revealed that the Salt Lake City bid for the 1998 Winter Olympics was accompanied by a range of incentives for IOC representatives. Salt Lake City was one of five applicants for the games. The 1998 Games were awarded to Nagano and it subsequently transpired that that city also provided a range of questionable gifts for IOC members.

Zimbalist (2015) explains how the monopoly position of the Olympic organisation is used to extract resources from the bidding cities. He draws attention to the difference between the usual bidding competition and the situation that occurred when Los Angeles was the only city that bid for the 1984 games. The bargaining position of Los Angeles helped make the games a financial success despite the boycott of the games by the USSR. The bargaining position of the Olympic Council relative to the competing cities since 1984 is presented in Table 2.

The Simpsons also illustrates other commercial issues surrounding the Olympics. For example, many advocates of hosting major sporting events exaggerate the benefits and minimise the costs.[7] Many will recognise the black humour in the words of newscaster Ken Brockman when he says that economists predict that Springfield will experience the same boom that Sarajevo enjoyed after the 1984 Games. Sarajevo hosted the 1984 Winter Olympics. Within a decade Sarajevo was a war zone. While the 1984 summer games in Los Angeles were a success, the USSR boycott did have implications for a McDonald's promotion. McDonald's gave customers scratch cards that revealed an Olympic event. If a US athlete won gold in that event then McDonald's gave the customer an item from the menu free of charge. Many cards revealed events where the communist countries were expected to win gold. This element of the 1984 Summer Games is lampooned in "*Lisa's First Word"* where McDonald's is replaced by Krusty Burgers.

If Salt Lake City is deemed a turning point in the history of the Olympic movement then it is possible that the events of May 27, 2015 will prove to be a watershed in the history of FIFA. On that day several FIFA officials were arrested in Switzerland on corruption charges. Many of the corruption charges relate to allegations surrounding the awarding of host country status for various World Cups. The events lead to *The Simpsons* being labelled prophetic. The episode *"You Don't Have to Live Like a Referee"* was aired in March 2014. In the episode, Homer is invited to referee in the tournament because of his integrity as a referee (specifically, his red carding Lisa in "*Marge Gamer"*). While issuing the invitation the executive Vice-President of the World Football Federation complains about the bribery of referees and says "The rot is everywhere. In fact, I see that I myself am about to be arrested for corruption." These issues are likely to remain a topical source of material for the economic instructor in the years ahead.

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[7] See Baade (1996), Dawson (2012), Humphreys & Prokopowicz (2007), Szymanski (2009), and Flyvbjerg & Stewart (2012).

Table 2: Number of Applicant Cities for Olympic Games, 1984-2018

Summer Games			Winter Games	
Applicants	Host City	Year	Applicants	Host City
1	Los Angeles	1984	3	Sarajevo
2	Seoul	1988	3	Calgary
6	Barcelona	1992	7	Albertville
		1994	4	Lillehammer
6	Atlanta	1996		
		1998	5	Nagano
8	Sydney	2000		
		2002	9	Salt Lake City
12	Athens	2004		
		2006	6	Turin
10	Beijing	2008		
		2010	8	Vancouver
9	London	2012		
		2014	7	Sochi
7	Rio de Janeiro	2016		
		2018	3	Pyeongchang

Competition and the Rules of the Game

Economic performance depends crucially on good rules and their impartial enforcement. Within these rules or institutions, competitive pressure act to coordinate human action. Rogers and Boettke (2014) make, and illustrate, the points with sporting examples taken from *The Simpsons*. Specifically, they use Homer's performance as a referee in "*Marge Gamer*". In the episode, Homer agrees to referee one of Lisa's games when the original referee opts out because of the abuse he is getting. Homer embarrasses Lisa with his poor refereeing. Lisa's criticism encourages him to learn more about the game. He becomes a better referee but his decisions tend to favour Lisa. After an intervention by Brazilian World Cup winner Ronaldo, Homer understands that Lisa is simulating being fouled. Homer even issues Lisa a red card. Lisa sees the error of her ways and decides to play for fun in the future. Homer's integrity for enforcing the rules of the game is also illustrated elsewhere in *The Simpsons*. In "*You Don't Have to Live Like a Referee*" he refuses bribes, and faces down death threats, to impartially referee at the FIFA World Cup. In "*Hello Gutter, Hello Fadder*" Homer denies Maggie a 300 game in bowling because she crossed the line.

Any game will break down where there is corruption or impartial enforcement of the rules. The game can also breakdown where the rules are poorly defined or where the rules provide participants with perverse incentives. Sport offers economists an opportunity to examine the implications of alternative rules for a game. For example, sporting competitions can be designed as leagues, elimination tournaments, or a hybrid of both league and elimination tournament.[8] A league is the usual format chosen for team competitions. By providing a fixed number of games, a league format facilitates commercial planning for team owners. Elimination tournaments are the norm for individual sports where the athletes have less bargaining power relative to the governing body than is the case for teams, e.g. athletics, boxing and tennis. There is also some evidence to suggest that fans prefer elimination tournaments. As a result, many sports organisations determine the champions by running an elimination tournament – sometimes after the regular season league games have been completed, and sometimes as the latter end of a mixed league/knock-out format.

Each of these tournament designs are referenced in *The Simpsons*. References to the league format can be found in the episodes dealing with the Springfield Isotopes baseball team that play minor league, e.g. *"Dancin' Homer"* and *"Hungry, Hungry Homer"*. Elimination tournaments can be found in "*Dead Putting Society*", "*Homer at Bat*", and "*Boy Meets Curl*". An alternative to the league or elimination tournament is the ladder tournament. The ladder format is used by the Association of Springfield Semi-

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[8] Szymanski (2012) investigates competition design, considering both open and closed systems.

Pro Boxers and the bowling association in which Homer's Pin Pals team competes in "*Team Homer*". The basic operation of the tournament involves one competitor challenging another to a game. If the lower ranked competitor wins then the competitors swap places on the ladder.

Many of the issues dealing with the rules of the game, and the competition within these rules, are seen in "*Saddlesore Galactica*". The episode opens with Springfield Elementary Band being narrowly defeated by Ogdenville in a musical competition. The use of strictly forbidden glow-sticks by Ogdenville helps them win. Lisa complains and eventually succeeds in having the result reversed. Ogdenville broke the rules that regulated the competition and were punished. The main plot of the episode involves horseracing. Homer and Bart rescue a horse called Duncan from an abusive owner. Duncan costs $500 a week to keep as a pet so Homer decides to use him as a racehorse. Duncan is too timid for racing so Homer and Bart give him a make-over and a name change. Duncan becomes Furious-D. He intimidates his rivals and starts winning races with Bart as his jockey. The remaining jockeys are upset and invite Homer to a meeting where they ask him to lose races. Homer refuses and Furious-D wins the Springfield Derby much to the annoyance of the jockeys.

"Saddlesore Galactica" raises many issues about the appropriate level of competition. In their efforts to compete, Ogdenville overstepped the mark with the use of glow-sticks. In sport, a win-at-all-costs attitude can lead to strategic fouling or steroid abuse. In their efforts to win, Homer and Bart get Furious-D to adopt a different approach. Is the intimidation used by Furious-D acceptable? In their efforts to be successful, the jockeys asked Homer to fix the outcome of a sporting competition. Is this form of collusion acceptable? The episode provides a starting point for a discussion on the nature of competition and the rules that incentivise too much, or too little, competition.

Economic Woman and Sabermetrics

In "*HOMЯ*" Homer Simpson has a crayon removed from his brain. The crayon entered his brain through his nose when he was a child. When the crayon is removed Homer's intelligence increases dramatically. However, his popularity and happiness declines. He longs to return to his old self. Moe aids this process by reinserting the crayon. As Moe sinks the crayon deeper and deeper into Homer's brain, Homer makes increasingly irrational statements. During the procedure Homer chants "De-fence! De-fence!" Moe replies "That's pretty dumb, but..." before pushing the crayon further into Homer's brain to which Homer says "Extended warranty? How can I lose?" The belief that defence wins games is questionable (Moskowitz & Wertheim, 2011). Table 3 presents some winning percentages for games where teams are classified by the strength of their defence and offence relative to the opposition. It raises questions about why fans chant for the defence and not the offence. This material can be used to motivate a discussion on individuals' understanding of probabilities.

Table 3: Percentage Wins for Defence and Offence

Sport	Defence	Offence
NFL (1967-2010)		
44 Super Bowls	65.9	54.5
407 Playoff Games	58	62
NBA (1947-2010)		
64 Championships	14.1	10.9
Playoff Games	54.4	54.8
MLB (1911-2010)		
World Series	44	54
Postseason Games	50.8	51.8

Notes: Percentages can add to more than 100% because a team can have both the best defence and best offence.

The extent to which individuals understand probabilities and their attitude to risk is examined in "*MoneyBart*". The title is a reference to the Michael Lewis's *Moneyball* - a book that documents the role of Paul DePodesta and Billy Beane during an upturn in the fortunes of the Oakland A's. DePodesta graduated from Harvard in 1995 with a degree in economics and it is this academic background that influences his analysis of baseball. In *"MoneyBart"* Lisa take the opportunity to increase her extracurricular activities by offering to coach Bart's little league baseball team the Springfield Isotot's. With very little knowledge of baseball, Lisa turns to those expected to have an intuitive understanding of the game, the bar-stoolers in Moe's Tavern. It is in the local tavern however that she comes across Professor Frink who introduces her to the statistical side of baseball and the power of sabermetrics. Lisa

instantly becomes hooked and can be found working with her laptop resting on a range of books that included *Moneyball* and *Bill James Historical Baseball Abstract*.

Lisa devises a strategy for the team based on her analysis. Her logical strategy pushes the team up the league. However, Bart believes Lisa is taking the fun out of baseball. In one particular play, Lisa's statistically grounded advice is to play the percentages but Bart decides to swing at the ball, smashes a homerun, and wins the game for the team. Bart justifies his actions by telling Lisa he was on a hot streak. Lisa informs him that the hot hand is a statistical illusion and Bart is removed from the team (support for Lisa can be found in Bar-Eli, Avugos and Raab (2006)). This decision causes much family conflict. Bart is reinstated for the last play of the championship final as a pinch-runner. He defies Lisa and steals second and third bases. A furious Lisa tells Bart that it is statistically impossible to steal a home run but nevertheless Bart goes for it. As Bart approaches home plate, Lisa's fury turns to joy as her emotions get the better of her and she falls in love with the thrills of baseball rather than the power of statistics. Bart fails in his endeavours, getting tagged out at the plate and as the commentator neatly surmises "it's a triumph of number crunching over the human spirit".

"MoneyBart" can be used to introduce students to the calculation of some basic probabilities. The decision on base stealing should depend on the probability of success. This can be calculated using a Run Expectancy Matrix (REM). The REM gives the expected value of runs for each position of play. For example, in Table 4, if the game has a runner on 1st and zero outs then the expected run value of this situation is 0.75. Is it worth stealing a base? A successful steal would improve the expected run value to 0.95 but if the player was caught stealing the value would drop to 0.25. In other words there is a possibility of a 0.2 gain (=0.95-0.75) and a 0.5 loss (=0.75-0.25).

Table 4: Run Expectancy Matrix

Runners On	0 Outs	1 Out	2 Out
None		0.25	
1st only	0.75		
2nd only	0.95		
3rd only			
1st and 2nd			
1st and 3rd			
2nd and 3rd			
1st, 2nd, and 3rd			

Note: Numbers are placed in only three cells to facilitate exposition. The full matrix is produced to show the possible game states; numbers in the above example are hypothetical.

What probability of success would make it worth taking this risk? The probability (p) is calculated by solving the following equation where the expected value of a successful steal is equal to the expected value from getting caught stealing. Equation 1 sets the expected value of the gain equal to the expected value of a loss.

$$\text{P(gain)} - \text{(1-P)(loss)} = 0 \qquad \text{(Equation 1)}$$

Solving for Equation 1 give p equal to the loss divided by the loss plus the gain (= Loss / [Loss + Gain]). For the situation outlined in Table 4, the runner should attempt to steal the base where the probability is greater than 0.7145.

Probabilities are also important for the analysis of mixed strategy situations. In "*Lisa on Ice*" Lisa is failing gym class and will only pass if she joins a sport outside of school. Fortunately for Lisa, Apu notices her blocking skills when Bart is shooting pieces of litter at her with his ice-hockey stick. Apu signs Lisa to play in goal for his Gougers team. This places Lisa against Bart when her team is scheduled to play Bart's team – the Mighty Pigs coached by Chief Wiggum. With four seconds to go the Mighty Pigs are awarded a penalty. Bart is the penalty taker and Lisa is the goalie. This situation can be used to explain the benefits of a mixed strategy. Bart can play one of two shots. He can play the puck to the right of Lisa or to the left of Lisa. Lisa has to decide what shot to cover. The speed of the puck is such that she cannot wait until it is struck, see where it is going, and then react by going that side. Lisa has to make up her mind simultaneously with Bart hitting the puck.

Let us put percentages on the possible success rate Bart might achieve depending on the shot he selects and the defensive strategy adopted by Lisa. These numbers are presented in Table 5. Because it is a zero sum game, we only need to specify Bart's success rate because if Bart is successful 90% of the time then by definition Lisa is successful 10% of the time. Bart's shots with the lowest success rate are the ones where Lisa correctly guesses his shot and covers that side of the goal. For example, if Bart decides to go to the Left and Lisa defends that shot then Bart is successful only 20% of the time. Where Lisa guesses incorrectly then Bart achieved his highest success rates. If he goes Left and she covers a potential shot to the right then he is successful 90% of the time. If he opts to go to the Right and she covers a shot to the Left then he is successful 80% of the time.

Table 5: A Penalty Shot Game

		Lisa	
		Right	**Left**
Bart	**Right**	50	80
	Left	90	20

We can see from Table 5 that neither Bart nor Lisa has a dominant strategy. There is no (Nash) equilibrium for a pure strategy. If we take any of the 4 payoffs there is an incentive for one of the players to play a different strategy. For example, (Left, Left) cannot be an equilibrium because Bart would be better off by changing his option to Right. And, if we were at (Right, Left), Lisa has an incentive to change her strategy to Right. And, so forth.

There is one clear message from Table 5. Do not be predictable. If Bart is predictable then Lisa will know what shot to defend. If he predictably goes Right he will succeed only 50% of the time. If he predictably goes Left then he will only be successful 20% of the time. If Lisa is predictable in the shot she defends then she will lose out. If she always covers Right then Bart will go Left and be successful 90% of the time. If Lisa always covers Left then Bart will hit the shot Right and be successful 80% of the time. Being predictable costs a player. Therefore the players have to opt for a mixed strategy.

Being unpredictable is more than just tossing a coin. Tossing a coin implies going with each strategy half of the time. However, there is nothing to say that opting for each strategy half of the time is optimal. It is possible to work out mathematically the proportion of time Bart should play each shot. The probability with which Bart should play each shot requires us to add a row to the payoff matrix. Into this row we place the payoffs Bart will get depending on the pure strategy Lisa employs against him. This is called the p-mix and is presented in Table 6. For example, if Lisa covers Right every time then Bart will be successful 50% multiplied by the proportion of the time he goes Right plus 90% multiplied by the proportion of the time he goes Left. In equation terms, it is $50p + 90(1-p)$. The situation where Lisa covers Left all the time is represented by the equation $80p + 20(1-p)$.

Table 6: Bart's p-mix

		Lisa	
		Right	**Left**
	Right	50	80
Bart	*Left*	90	20
	p-mix	*$50p + 90(1-p)$*	*$80p + 20(1-p)$*

We can solve for p by setting the two equations equal to each other

$50p + 90(1-p) = 80p + 20(1-p)$

$0.70 = p$

This means Bart should select Right randomly 70% of the time. What success rate can Bart expect if he goes Right at random 70% of the time? Given $p = 0.7$ we can substitute it back into one of the equations to get the success rate that Bart can expect. The success rate is

$= 50(0.7) + 90(1.0 - 0.7)$

$= 62$

Tables 4 to 6 illustrated the issue surrounding the calculation of probabilities for competitors. The difficulties some spectators and bettors have calculating probabilities and understanding risk can be illustrated in betting markets. Homer is not a successful bettor. This can be seen from the very beginning of *The Simpsons*. In "*Simpsons Roasting on an Open Fire*", Homer loses the money he has for Christmas

when he bets on a dog called Santa's Little Helper at odds of 99/1. The bet was placed because Homer liked the dog's name! Two seasons later, in "*Lisa the Greek*", Homer is still losing money betting on sporting contests. However, Lisa helps him to turn this around and she is perfect in her picks for eight straight weeks. Lisa success is somewhat unrealistic. A better example from the same episode is the TV tipster, Smooth Jimmy Apollo who manages an unspectacular 52% success rate. Apollo's success rate suggests that the betting market is efficient.

Conclusion

Reference to examples from *The Simpsons* can do some of the heavy lifting when teaching economics. Contributors to Hall (2014) repeatedly make such a claim (usually implicitly). We agree. We argue that the claim can be extended to the teaching of sports economics. *The Simpsons* can teach us a fair deal about the economics of sport. While we do not claim that *The Simpsons* offers enough material for a full course in sports economics, we contend that it offers many entry points for students interested in the subject. In many cases, the treatment of a topic by *The Simpsons* will provide illustrations that focus on the issue at hand. In other cases, it only provides an introductory talking point.

Becker and Watts (1996) document that economic educators are already using examples taken from sport to illustrate economic concepts in the teaching of undergraduates. One of the advantages of sport is the availability of data on a variety of topics. This data can shine a light on many a discussion of economic theory. We have provided examples on this in terms of sports economics. In this way, it can be used to assess economic theory against the evidence. While we have only used summary statistics in this paper, it is a relatively short step to testing for statistical significance.

Our paper also uses *The Simpsons* to introduce and explain some basic decision making in risky situations. Our specific examples involve base stealing and penalty taking. Bart and Lisa provide the context and background stories. Both involve the calculation of some basic probabilities. The latter explains the benefits of mixed strategies. To aid instruction, some of the links between topics in sports economics, the academic literature, and particular episodes of *The Simpsons*, the appendix includes a summary table. Economic educators will also find the internet a valuable support mechanism as every episode of *The Simpsons* has its own Wikipedia page that outlines the plot, cultural references and impact of the episode. We hope that the paper will encourage others to use *The Simpsons* as one of a variety of teaching aids in economics. For those who already use such an approach we hope that we have provided additional material and perspectives.

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Simpsons Episodes

"Simpsons Roasting on an Open Fire" (Season 1: Episode 1)
"Dancin' Homer" (Season 2: Episode 5)
"Dead Putting Society" (Season 2: Episode 6)
"Lisa the Greek" (Season 3: Episode 14)
"Homer at Bat" (Season 3: Episode 17)
"Lisa's First Word" (Season 4: Episode 10)
"Lisa on Ice" (Season 6: Episode 8)
"Team Homer" (Season 7: Episode 12)
"The Homer They Fall" (Season 8: Episode 3)
"The Cartridge Family" (Season 9: Episode 5)
"The Old Man and the "C" Student" (Season 10: Episode 20)
"Hello Gutter, Hello Fadder" (Season 11: Episode 6)
"Saddlesore Galactica" (Season 11: Episode 13)
"HOMR" (Season 12: Episode 9)
"Hungry, Hungry Homer" (Season 12: Episode 15)
"Marge Gamer" (Season 18: Episode 17)
"The Burns and the Bees" (Season 20: Episode 8)
"Boy Meets Curl" (Season 21: Episode 12)
"MoneyBart" (Season 22: Episode 3)
"Them, Robot" (Season 23: Episode 17)
"You Don't Have to Live Like a Referee" (Season 25: Episode 16)

Appendix 1

Episode	Sports Economics Topic	Academic Reference	Key Character(s) Quote
Homer at the Bat (S3:E17)	Distribution of Talent; Collective Bargaining	Rottenberg (1956)	**Mr Burns**: "I've decided to bring in a few ringers - professional baseballers. We'll give them token jobs at the plant and have them play on our softball team".
Saddlesore Galactica (S11:E13)	Competitive Balance; Uncertainty of Outcome; Collusion	Neale (1964)	**Homer**: "Son, don't ask why, but you have to lose the big race. **Bart**: You want me to lose the Springfield Derby? But you always taught me that winning was everything".
The Homer They Fall (S8: E3)	Competitive Balance; Uncertainty of Outcome	Neale (1964)	**Lucius Sweet**: "Well, the fans are weary of fights that are over before they have an opportunity to even get drunk...I just need a body who can sustain verticality for three rounds".
The Burns and the Bees (S20:E8)	Economic impact of Stadium Construction; Franchise Location	Fort (2010); Leeds & Von Allmen (2013)	**Mr Burns**: "Welcome to the American dream. A billionaire, using public funds, to construct a private playground for the rich and powerful".
The Old Man and the "C" Student (S10:E12)	Economic Impact of Hosting Major Sports Events	Humphreys & Prokopowicz (2007)	**Kent Brockman**: "Springfield was shocked today to learn it will host the next Olympics. Economists predict our city will experience the same boom that Sarajevo enjoyed after the 1984 Games".
MoneyBart (S22: E3)	Sabermetrics; Rationality	Lewis (2004); Bar-Eli, Avugos & Raab, M. (2006)	**Commentator**: "it's a triumph of number crunching over the human spirit".
Lisa on Ice (S6:E8)	Competition Design; Game Theory-Zero Sum and Positive Sum Games	Palacios-Huerta, (2003); Szymanski (2012)	**Homer**: "It's your child versus mine! [Marge] The winner will be showered with praise! The loser will be taunted and booed.....Tie game?! - What the hell?! This is outrageous".
Dead Putting Society (S2:E6)	Competition Design; Game Theory-Zero Sum and Positive Sum Games	Palacios-Huerta, (2003); Szymanski (2012)	**Flanders**: "All right! Homer, our kids showed us something today, huh? By working together, we can both be winners and neither of us has to do that wager".
The Cartridge Family (S9:E5)	Tastes; Demand for Sport; Competition Design; Incentives	Simmons (2005)	**Sideshow Mel**: "I can't bear this [soccer] any longer, I'm leaving". **Moe**: "Hey, not before me you ain't." **Flanders**: "Now, now, there's plenty of exits for everyone".
Marge Gamer (S18: E17)	Bias in Sport	Sutter & Kocher (2004) Pollard & Pollard (2005)	**Homer**: "Foul on the other girl! Lisa gets a penalty kick, and every other kid has to pay her a dollar".
You Don't Have to Live Like a Referee (S25:E16)	Governance of Sport	Caruso, R. (2009)	**Vice President of the World Football Federation**: "Mr Simpson, please help us. The rot is everywhere. In fact, I see that eh, I myself am about to be arrested for corruption".