# J O U R N A L O F ECONOMICS and FINANCE EDUCATION 



ACADEMY of ECONOMICS and FINANCE


## Volume 18 FALL 2019 Number 2

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# Community of Inquiry for Blended Learning in Finance 

Maretno A. Harjoto and Abraham U. Park ${ }^{1}$


#### Abstract

This study reports the differences in students' learning experiences between blended and face-to-face modalities in a finance course. We hypothesize that the relative importance of teaching presence and social presence are different in blended courses than in face-to-face courses. Based on course evaluations from a finance course, we find evidence that teaching presence is lower in blended courses. However, we find that social presence and students' academic achievement are higher in blended courses. This result implies that the overall quality of students' educational experience can be maintained or enhanced if social presence can sufficiently compensate for the reduced teaching presence.


## Introduction

As universities worldwide grapple with the transformation of the learning environment from fully face-to-face ( FtF ) to increasing mixtures of FtF and online classes, it is more imperative than ever that we find effective ways to understand, measure, and best implement blended learning in its various forms. Proponents of blended learning have asserted it has great potential to enhance students' educational experience through increasing students' engagement and collaboration, as well as increasing flexibility and time for students to self-reflect and deepen their cognitive learning (Arbaugh and Duray 2002; Bull et al. 2012; Garrison and Kanuka 2004; Klein et al. 2006; Vaughan et al. 2013).

Garrison and Kanuka (2004) argue that blended learning could potentially deliver a higher level of student educational experience because it would combine the strengths of FtF and online learning activities. However, they also concede that blended learning presents its own challenges, since instructor presence diminishes compared to traditional FtF courses. Unlike a traditional classroom in which an instructor's role is limited to providing direct instruction and course content, the instructor's role in a blended course shifts to initiating, facilitating, and managing the community of inquiry.

Garrison et al. (2000) introduce the community of inquiry (CoI) framework, which identified three experiential elements, cognitive presence, social presence, and teaching presence, to analyze changes in students' educational experience under different pedagogical modalities in higher education. In this paper, we extend the literature by using the CoI framework to evaluate students' learning experience in blended versus FtF modalities by comparing student evaluation surveys for a finance course taught by the same instructor. We present our hypotheses and findings in the following three areas: (1) students' perception of teaching presence; (2) the shift in students' social presence; (3) and students' learning outcome.

## A Brief Literature Review

Garrison et al. (2000) published the first of a series of articles describing the community of inquiry (CoI) as a conceptual framework with which to analyze and understand both the potential and the effectiveness of e-learning. They adopted the phrase "community of inquiry" from Lipman (1991), whose work in this regard

[^0]was founded on John Dewey's theory of inquiry (Dewey 1938). Garrison et al. (2000) explain CoI simply as a collective of individuals who are involved in a community of discussions, dialogues, debates, etc. to form empirical or conceptual inquiries toward a new discovery of knowledge.

Originally, the CoI framework emerged in the specific context of computer-mediated communication in higher education. Garrison et al. (2000) then adapted the framework to an online environment to analyze students' learning processes using three components: cognitive presence, social presence, and teaching presence. Cognitive presence describes the progressive phases of practical inquiry that lead to resolution of a problem or dilemma by each member of the community. Social presence is the development of a class climate, group cohesion, emotional expression, and interpersonal relationships among members of the community. Teaching presence is the degree of direct instruction, leadership, guidance, and instructional management throughout the course of inquiry. Garrison et al. (2000) indicate that teaching presence and social presence are means to support and promote higher cognitive presence; however, this statement can be misleading, as the CoI framework is a process model that highlights the importance of the interaction of all presences, and in particular, the intersections among them (Garrison et al. 2000). In fact, social presence must be seen as a mediating variable between teaching and cognitive presence, while teaching presence is a critical determinant of student satisfaction, sense of community, and a causal influence for social and cognitive presence (Garrison et al. 2000). In short, then, the basic goal of the CoI framework is to describe the creation, measurement, and sustainability of a community of inquiry using collaborative and dynamic elements that produce an effective educational experience for students. We use the CoI framework to analyze blended learning.

Unlike purely online or FtF courses, blended courses combine FtF and online modes of delivering course content to students. While the mixture between online and FtF components in blended courses can vary between $20 \%$ and $80 \%$ online (Arbaugh 2014), the goal is to use the best or most appropriate features of each method to enhance the student learning experience and maximize student success (Larson and Sung 2009). While Graham (2006) has described blended learning as a "blend between online and face-to-face instructional methods," Garrison and Kanuka (2004) have refined the definition as a "careful integration between the traditional face-to-face learning and the online learning experiences." Helms (2014) indicates that there are several important elements of instructional designs for blended courses such as scheduling, communication, course content, motivation, and the design of course evaluations.

According to Garrison and Kanuka (2004), a blended course could deliver a higher order of educational experience from critical discourse and reflective thinking because it would combine the strengths of FtF and online learning activities. Other researchers have claimed that blended courses could increase students’ opportunities to work independently while allowing for more flexibility, particularly to self-reflect and to form their own deeper, cognitive learning (Arbaugh and Duray 2002; Bull et al. 2012; Klein et al. 2006). However, blended learning has also been criticized for its diminished teaching and social presence, namely, the reduction of the teacher's direct instruction, personal attention, assistance, social cues, and the reduction of FtF interactions, especially among students who have relatively low self-discipline and self-motivation (Laurillard 1993; Lim and Kim 2003).

The current research on student learning outcomes from blended courses offers mixed results on the effectiveness of such classes when compared to traditional FtF courses. Arbaugh et al. (2009) found that online and blended courses provided comparable learning outcomes when compared to traditional FtF courses. Means et al. (2010) concluded that blended courses provided higher learning outcomes than FtF courses. Furthermore, Lopez-Perez et al. (2011) showed that blended learning increased students' exam scores and reduced dropout rates. In contrast, Ginns and Ellis (2007) found that students' perception of instructors' teaching effectiveness in blended courses was only marginally related to students' deep learning outcomes (Biggs et al. 2001). Additionally, Asarta and Schmidt (2017) found that in a low-grade-pointaverage (GPA) group of students, academic performance was higher in FtF courses, while in a high-GPA group, academic performance was higher in blended courses.

As to student satisfaction, extant literature also found mixed results between blended and FtF courses. Some studies showed that student satisfaction with the instructor's teaching effectiveness was higher in blended courses (Larson and Sung 2009). Others, like Dziuban and Moskal (2011), found no significant difference in student satisfaction between blended and FtF courses in end-of-semester student evaluations. Finally, there have been studies that have reported lower student satisfaction for blended courses (e.g., Ginns and Ellis 2007).

## Hypotheses

Applying the CoI framework, our study examines how the three components (cognitive, social, and teaching presence) change as colleges and universities increasingly rely on blended courses. One of the challenges that has been noted for blended courses is that students experience diminished teaching presence due to less real-time interaction with their instructors (Garrison and Kanuka 2004). Vaughan et al. (2013) have asserted that while there are fewer live interactions, blended courses have the potential to provide more continuous presence and opportunities for students to dialogue with their peers and with their instructors beyond the space and time limitations of the classroom. Although instructors' teaching presence in a blended course could be experienced many different ways, such as course design and management, instructors' announcements, emails, discussion boards, and virtual online meetings, researchers have argued that the online component of a blended course provides less direct instruction, personal attention, and significantly fewer social cues from both instructors and students compared to a fully FtF course (Garrison and Kanuka 2004; Laurillard 1993; Lim and Kim 2003). Additionally, synchronous online classes in blended courses tend to be shorter in duration since students have lower attention spans for online classes than for FtF classes (Dewar and Whittington 2000).

Thus, our first research question asks whether students' perception of teaching presence, measured by the course effectiveness and the instructors' teaching effectiveness in a course taught by the same instructor with the same content, is lower in blended courses compared to FtF courses. Since teaching presence encompasses initiating, facilitating, and managing the CoI as well as delivering course content, and given the fact that blended courses have shorter FtF time, we postulate that students' perception of teaching presence, as measured by course effectiveness and instructors' teaching effectiveness, would be lower in blended courses compare to FtF courses. Our first hypothesis is stated as the following:

H1: Students' perception of teaching presence, measured by ratings for the course and for instructor
effectiveness, is lower in a blended course than in a traditional FtF course.
Next, we explore how intersections among three components of CoI change as we move from traditional FtF courses to blended courses. As Garrison et al. (2000) indicate, teaching presence and social presence are critical as they support and promote cognitive presence. The social constructivist paradigm also argues that "deep learning" stems from continuous social activities where students cooperate, discuss, critically think, and problem-solve with their peers (Berger and Luckmann 1966; Palincsar 1998). Therefore, it is critical to examine whether students in blended courses compensate for reduced teaching presence with an increase in social presence to preserve the same level of cognitive presence, as several researchers have argued. We illustrate this tradeoff in Figure 1 as we move from panel A (a traditional FtF course) into panel B (a blended course). Thus, our second hypothesis can be stated as the following:

H2: Students in a blended course tend to rely more on social presence, evidenced by increased use of
study groups, than students in a traditional FtF course.
Finally, we pose the question of whether there is a significant difference between blended and FtF courses in students' overall learning effectiveness or educational experience (represented by area E in both panels A and B of Figure 1), measured by their academic performance (course grades). If students in blended courses are able to sufficiently increase social presence to compensate for lower teaching presence relative to students in traditional FtF courses, then the intersection of teaching, social, and cognitive presences could produce higher student learning effectiveness, as represented by comparatively higher academic achievement, in blended courses than in FtF courses. Otherwise, students' learning effectiveness in blended courses would be the same or even lower than in FtF courses. Thus, our third hypothesis is stated as the following:

H3: Students in a blended course experience a higher level of learning outcome, evidenced by academic performance (course grades), than students in a traditional FtF course if blended course students are able to increase their social presence to compensate for the decrease in teaching presence.

Figure 1: Changes in Community of Inquiry from a FtF Course into a Blended Course


## Sample and Descriptive Statistics

To test our three hypotheses, we used two sets of samples from sixteen total course sections: four sections of the blended format and twelve sections of the FtF format, taught by the same instructor during 2014 through 2017 in a graduate finance core course for business school students at a university in the western part of the United States. Students in both FtF and blended courses were provided with two types of pre-lecture videos: screencast and YouTube videos. The screencast videos contained pre-lecture recordings that show basic step-by-step lectures, i.e., the instructor manually writes and explains the lecture on PowerPoint slides using a tablet personal computer (tablet PC). Both handwritings and voices were recorded using the TechSmith Relay. The YouTube videos were created by videotaping the instructor explaining the pre-written whiteboards in a classroom without students. In the YouTube videos, the instructor explained the same basic step-by-step lectures as the screencast lectures and posted these videos on the YouTube unlisted channel (e.g., http://www.YouTube.com/watch?v=oe6gdlK6zXw).

The blended course consisted of 40 percent in-person ( FtF ) classes and 60 percent online classes. Inperson and online classes were alternated in a rotational system every two-weeks for 14 weeks (blended learning with a rotation model). In blended courses, each online class was held using Adobe Connect for one hour and each FtF class was held in a four-hour class format similar to traditional FtF courses. As with FtF courses, exams in blended courses were administered during in-person (face-to-face) classes where the students were physically present. The teaching presence in blended courses was enforced through weekly announcements and discussion boards that were not part of the course grade. Virtual online meetings and email communications based on students' requests also represent additional forms of teaching presence.

Our first sample came from course evaluations conducted online at the end of the semester for both blended and FtF courses. Appendix A presents the end-of-semester course evaluation questionnaire. This course evaluation questionnaire (rubric) is set by the university administration and it is used to evaluate all instructors' teaching effectiveness for both FtF and blended courses. We compared this course evaluation questionnaire with the questionnaire used by Garrison et al. (2010), and found that our end-of-semester course evaluation questions are consistent with the ones they used to measure teaching presence.

We collected 59 usable responses from blended courses and 228 usable responses from FtF courses from the end-of-semester course evaluations. Table 1 presents the descriptive statistics and univariate analysis of our first sample set of teaching and course evaluation scores for blended (Blended) and FtF courses (FtF). Overall, our results indicate support for our first hypothesis (H1), that the perception of overall course effectiveness is significantly lower for blended course students than for FtF course students ( C 1 to C 6 ). We also find that students in blended courses tend to give a lower rating for course characteristics (course goals
and objectives, course requirements, etc.) compared to those in FtF courses, except for the course's level of intellectual challenge (C6).

Table 1: End of Semester Students' Evaluation

| No | Course Survey Questions | Blended | FtF | T-ratios |
| :--- | :--- | :---: | :---: | :---: |
| C1 | Goals and objectives of this course were clearly stated | 4.712 | 4.907 | $-3.050^{* * *}$ |
| C2 | Course assignments/requirements were clearly defined | 4.678 | 4.943 | $-5.089^{* * *}$ |
| C3 | Course had relevant readings/textbooks/assignments | 4.457 | 4.837 | $-4.693^{* * *}$ |
| C4 | Class time was spent on relevant and important material or |  |  |  |
|  | activities | 4.627 | 4.903 | $-5.505^{* * *}$ |
| C5 | Course increased my knowledge of subject matter | 4.644 | 4.917 | $-3.794^{* * *}$ |
| C6 | Course was intellectually challenging | 4.983 | 4.855 | $2.197^{* *}$ |
| I1 | Instructor presented content in an informative way | 4.763 | 4.929 | $-3.438^{* * *}$ |
| I2 | Instructor increased my interest in the subject matter | 4.424 | 4.838 | $-4.454^{* * *}$ |
| I3 | Instructor provided useful feedback to students | 4.712 | 4.907 | $-3.716^{* *}$ |
| I4 | Instructor clearly defined his/her methods of evaluating students | 4.492 | 4.873 | $-5.342^{* * *}$ |
| I5 | Instructor was well-prepared for class | 4.882 | 4.947 | -1.622 |
| I6 | Instructor encouraged expression of diverse viewpoints | 4.389 | 4.890 | $-6.804^{* * *}$ |
| I7 | Instructor integrated practical applications into the course | 4.491 | 4.890 | $-6.105^{* * *}$ |
| I8 | Instructor effectively monitored students' understanding of the |  |  |  |
|  | subject matter | 4.508 | 4.908 | $-6.072^{* * *}$ |
| I9 | Instructor displayed caring and sensitivity toward students | 4.779 | 4.930 | $-3.116^{* * *}$ |
| I10 | Instructor assigned work which required critical thinking | 4.831 | 4.886 | 1.111 |
| I11 | Instructor encouraged respect for professional ethics and moral |  |  |  |
|  | values | 4.861 | 4.908 | $1.803^{*}$ |
| I12 | Overall, the course instructor was as effective teacher | 4.800 | 4.934 | $3.493^{* * *}$ |
| C1- |  |  |  |  |
| C6 | Average evaluation scores on Course characteristics | 4.684 | 4.894 | $4.679^{* * *}$ |
| I1- |  | 4.637 | 4.903 | $6.079^{* * *}$ |
| I12 | Average evaluation scores on Instructor characteristics | 0.9403 | 0.9280 |  |
|  | Cronbach's Alpha | 59 | 228 | 12 |

* significant at $10 \%$; ** significant at $5 \%$; *** significant at $1 \%$.

We also find that students in blended courses tend to give a lower rating on instructor characteristics (I1 to I12) than students in FtF courses, except for the level of instructor preparedness (I5) and the question of whether the instructor assigned work that required students' critical thinking (I10). On average, students in blended courses rated the overall instructor's teaching effectiveness (I12) more than 0.1 point lower (on a scale of 1-5) than students in FtF courses. This finding also supports our first hypothesis (H1) that on average, students in blended courses tend to assign a lower rating for their instructor's teaching effectiveness than students in FtF courses. More importantly, this finding also suggests that using the same rubrics from FtF courses to measure instructor and course effectiveness for blended courses will tend to produce lower evaluation scores.

We conducted Cronbach Alpha tests to examine the internal consistency and reliability of students' responses from both the blended and FtF courses. The Cronbach Alpha for blended and FtF courses are 0.94 and 0.93 , respectively, which indicate that the internal consistency and reliability of psychometric tests for all student responses from the end-of-semester course evaluations are considered to be excellent (Cronbach 1951; Nunnally and Bernstein 1994).

Our second sample set came from anonymous surveys conducted during the middle of the semester after students had taken their midterm exam and received their midterm grades (mid-semester student survey). We re-calibrated students' ordinal rating from the mid-semester survey ( $1=$ strongly agree to $5=$ strongly disagree) into an ordinal rating that is consistent with the end of semester rating ( $1=$ strongly disagree to $5=$ strongly agree). The mid-semester student survey results are summarized in Table 2. The mid-semester survey questionnaire is presented in Appendix B, and the variable descriptions are presented in Appendix C. We collected 49 usable responses from blended courses and 210 usable responses from FtF courses. We were
unable to link the two samples by students' names because each sample was collected separately and anonymously.

Table 2: Descriptive Statistics from the Mid-Semester Students' Survey

| No | Variable | All Sample | Blended | FtF | T-ratio |
| :---: | :--- | :---: | :---: | :---: | :---: |
| 2 | Frequency | 1.425 | 2.103 | 1.268 | $8.63^{* * *}$ |
| 5 | HwQuizGrade | 3.540 | 3.204 | 3.619 | $-3.87^{* * *}$ |
| 5 | Flipped | 3.691 | 3.939 | 3.633 | $-1.88^{*}$ |
| 6 | Hourstudy | 6.396 | 10.265 | 5.493 | $7.89^{* * *}$ |
| 7 | Reqhourstudy | 8.901 | 12.959 | 7.955 | $5.96^{* * *}$ |
| 8 | Studygroup | 2.579 | 3.312 | 2.467 | $4.04^{* * *}$ |
| 9 | CumGPA | 3.453 | 3.579 | 3.423 | $3.82^{* *}$ |
| 10 | NumClass | 3.791 | 2.102 | 4.186 | $-16.74^{* * *}$ |
| 11 | Undergrad | 4.351 | 4.184 | 4.390 | -0.899 |
| 12 | Age | 25.992 | 29.469 | 25.181 | $7.36^{* * *}$ |
| 13 | Female (gender) | 0.486 | 0.673 | 0.443 | $2.95^{* * *}$ |
| 14 | International | 0.559 | 0.082 | 0.671 | $-8.43^{* * *}$ |
| 15 | WorkExperience | 3.659 | 8.479 | 2.534 | $10.41^{* *}$ |
| 16 | Midterm Exam | 83.239 | 86.765 | 82.417 | $3.03^{* *}$ |
| 17 | Expected Grade | 3.558 | 3.520 | 3.567 | -0.66 |
| 18 | Teaching Effectiveness | 4.428 | 4.239 | 4.469 | $-1.85^{*}$ |
| 19 | LikeClass | 0.289 | 0.265 | 0.295 | -0.41 |
| 20 | LikeVideo | 0.197 | 0.245 | 0.186 | 0.94 |
| 5 | YouTubereplace | 3.474 | 4.082 | 3.333 | $3.94^{* *}$ |
| 5 | Screencastreplace | 3.266 | 3.571 | 3.195 | $1.88^{*}$ |
|  | Cronbach's Alpha | 0.742 | 0.728 | 0.795 |  |
|  | Number of observations | 259 | 49 | 210 |  |
|  | Number of Course Sections | 16 | 4 | 12 |  |
|  | *significant at $10 \% ; * *$ significant at $5 \% ; * *$ significant at $1 \%$. See Appendix C for variable descriptions. |  |  |  |  |

Based on our second sample, the univariate $t$-test results show that on average, blended course students tend to watch pre-lecture videos more frequently (Frequency) than FtF course students. Blended course students also tend to rely less on homework and quizzes (HWQuizGrade) for their learning, while having a better understanding of the flipped lecture format (Flipped) than FtF students. Furthermore, blended course students tend to spend more hours studying (Hourstudy), while tending to sense a greater need to spend more time studying in order to succeed in their classes (Reqhourstudy).

More importantly, we find that students from blended courses tend to use study groups (Studygroup) more frequently than FtF students. This finding is consistent with our second hypothesis (H2) that students from blended courses would rely more on social presence (learning from their peers) as a way to improve their educational experience. We also find that students in blended courses tend to have a significantly higher cumulative GPA and enroll in fewer courses simultaneously. Blended courses generally had older students (Age), higher percentages of female students (Female), students with more work experience (WorkExperience), and lower percentages of international students (International) than FtF courses.

Moreover, we find that blended course students tend to perform better on their midterm exam (MidtermExam) than FtF course students. This result provides evidence to support our third hypothesis (H3), that the students' learning outcome in a blended course is significantly different (higher) than in a traditional FtF course. However, we find that blended course students tend to give a lower rating on the overall instructional process (TeachingEffectiveness) than FtF course students. This result is consistent with the findings from our first sample dataset and our first hypothesis (H1) that students in blended courses tend to rate their instructor's teaching effectiveness lower than students in FtF courses.

We conducted Cronbach Alpha tests to examine the internal consistency and reliability of students' responses from the mid-semester students' survey data from the blended and FtF courses. The Cronbach Alpha for blended and FtF course are 0.7 and 0.8 , respectively, which indicate that internal consistency and reliability of psychometric tests for all students' responses from the end of semester course evaluation are considered acceptable.

## Regression Results

In order to examine the differential impact between blended and FtF learning on student learning (education) experience while controlling for student aptitude and other student characteristics, we conducted a multivariate regression analysis using ordinary least squares, with course sections clustering, using our second data sample. We used the second data sample set, based on mid-semester student surveys, because the questionnaire from our first data sample (the end-of-semester course evaluation) was established by the university and could not be modified or adjusted. Table 3 presents the regression results. The Blended variable represents an indicator variable that takes the value of one if the course section was taught in a blended format rather than a FtF format.

Table 3: Multivariate Regression Analysis

|  | Teaching Effectiveness | Study Group | Midterm Exam | Expect Grade |
| :---: | :---: | :---: | :---: | :---: |
| Blended | $\begin{aligned} & -0.4936 \\ & (2.24)^{* *} \end{aligned}$ | $\begin{gathered} 0.9824 \\ (3.72)^{* * *} \end{gathered}$ | $\begin{gathered} 3.8545 \\ (2.22)^{* *} \end{gathered}$ | $\begin{gathered} 0.2522 \\ (2.18)^{* *} \end{gathered}$ |
| Frequency | $\begin{gathered} 0.0005 \\ (0.00) \end{gathered}$ | $\begin{aligned} & 0.2868 \\ & (1.90)^{*} \end{aligned}$ | $\begin{gathered} -0.5174 \\ (0.85) \end{gathered}$ | $\begin{gathered} -0.0136 \\ (0.31) \end{gathered}$ |
| YouTube | $\begin{gathered} -0.0067 \\ (0.21) \end{gathered}$ | $\begin{gathered} -0.0048 \\ (0.06) \end{gathered}$ | $\begin{gathered} 0.1522 \\ (0.37) \end{gathered}$ | $\begin{gathered} 0.0223 \\ (1.36) \end{gathered}$ |
| Screencast | $\begin{aligned} & 0.0475 \\ & (1.61) \end{aligned}$ | $\begin{aligned} & -0.1274 \\ & (2.49)^{* *} \end{aligned}$ | $\begin{gathered} 0.0850 \\ (0.24) \end{gathered}$ | $\begin{gathered} 0.0081 \\ (0.45) \end{gathered}$ |
| HWQuizGrade | $\begin{gathered} 0.2176 \\ (2.72)^{* *} \end{gathered}$ | $\begin{gathered} 0.0627 \\ (0.58) \end{gathered}$ | $\begin{aligned} & 1.7929 \\ & (1.69) \end{aligned}$ | $\begin{gathered} 0.0652 \\ (1.77) \end{gathered}$ |
| Flipped | $\begin{aligned} & 0.0322 \\ & (1.23) \end{aligned}$ | $\begin{gathered} 0.0388 \\ (0.50) \end{gathered}$ | $\begin{gathered} -0.5346 \\ (0.85) \end{gathered}$ | $\begin{gathered} -0.0139 \\ (0.44) \end{gathered}$ |
| Hourstudy | $\begin{gathered} -0.0148 \\ (1.50) \end{gathered}$ | $\begin{gathered} 0.0212 \\ (0.73) \end{gathered}$ | $\begin{gathered} 0.0454 \\ (0.32) \end{gathered}$ | $\begin{gathered} 0.0035 \\ (0.53) \end{gathered}$ |
| CumGPA | $\begin{gathered} 0.5293 \\ (3.63)^{* * *} \end{gathered}$ | $\begin{gathered} -0.2620 \\ (0.69) \end{gathered}$ | $\begin{gathered} 13.9336 \\ (5.15)^{* * *} \end{gathered}$ | $\begin{gathered} 0.5858 \\ (5.01)^{* * *} \end{gathered}$ |
| NumClass | $\begin{gathered} -0.0071 \\ (1.82) \end{gathered}$ | $\begin{gathered} 0.0751 \\ (0.63) \end{gathered}$ | $\begin{gathered} -1.0929 \\ (1.02) \end{gathered}$ | $\begin{gathered} -0.0269 \\ (0.94) \end{gathered}$ |
| Undergrad | $\begin{gathered} -0.0333 \\ (1.11)^{*} \end{gathered}$ | $\begin{gathered} 0.0406 \\ (1.04) \end{gathered}$ | $\begin{gathered} 0.1364 \\ (0.48) \end{gathered}$ | $\begin{gathered} 0.0198 \\ (0.87) \end{gathered}$ |
| Age | $\begin{gathered} 0.0171 \\ (0.90) \end{gathered}$ | $\begin{gathered} 0.0034 \\ (0.07) \end{gathered}$ | $\begin{gathered} 0.2106 \\ (0.51) \end{gathered}$ | $\begin{gathered} -0.0063 \\ (0.38) \end{gathered}$ |
| Gender | $\begin{gathered} 0.0147 \\ (0.29) \end{gathered}$ | $\begin{gathered} 0.0261 \\ (0.30) \end{gathered}$ | $\begin{gathered} 0.2454 \\ (0.28) \end{gathered}$ | $\begin{gathered} 0.0156 \\ (0.37) \end{gathered}$ |
| International | $\begin{gathered} 0.0243 \\ (0.23) \end{gathered}$ | $\begin{gathered} 0.2384 \\ (1.52) \end{gathered}$ | $\begin{gathered} 3.6563 \\ (2.78)^{* *} \end{gathered}$ | $\begin{gathered} 0.4416 \\ (8.35)^{* *} \end{gathered}$ |
| WorkExperience | $\begin{gathered} -0.0050 \\ (0.24) \end{gathered}$ | $\begin{gathered} -0.0308 \\ (0.57) \end{gathered}$ | $\begin{gathered} -0.3074 \\ (0.77) \end{gathered}$ | $\begin{gathered} 0.0067 \\ (0.35) \end{gathered}$ |
| LikeClass | $\begin{gathered} 0.0178 \\ (0.15) \end{gathered}$ | $\begin{gathered} -0.1615 \\ (0.78) \end{gathered}$ | $\begin{gathered} 0.6598 \\ (0.56) \end{gathered}$ | $\begin{gathered} 0.0111 \\ (0.24) \end{gathered}$ |
| LikeVideo | $\begin{gathered} 0.0945 \\ (0.72) \end{gathered}$ | $\begin{aligned} & 0.1025 \\ & (0.49) \end{aligned}$ | $\begin{aligned} & 1.7444 \\ & (1.78) \end{aligned}$ | $\begin{gathered} 0.1648 \\ (1.46) \end{gathered}$ |
| Intercept | $\begin{aligned} & 1.2203 \\ & (1.38) \end{aligned}$ | $\begin{gathered} 2.2914 \\ (1.07) \end{gathered}$ | $\begin{gathered} 24.2009 \\ (1.68) \end{gathered}$ | $\begin{aligned} & 1.0146 \\ & (1.42) \end{aligned}$ |
| Number of observations <br> Adj. R-squared | $\begin{gathered} 259 \\ 0.2185 \\ \hline \end{gathered}$ | $\begin{gathered} 259 \\ 0.1816 \end{gathered}$ | $\begin{gathered} 259 \\ 0.2374 \\ \hline \end{gathered}$ | $\begin{gathered} 259 \\ 0.3099 \\ \hline \end{gathered}$ |

[^1]The dependent variable for the first column of Table 3 is the rating of the overall effectiveness of the instructional process (TeachingEffectiveness). We find that, on average, students in blended courses tend to give 0.4936 lower in rating score than students in FtF courses. This result provides empirical evidence to support our first hypothesis (H1), that students in blended courses tend to give lower ratings on the overall instructor's teaching effectiveness than in FtF courses.

We also find that students who rely more heavily on homework and practice quiz problems (HWQuizGrade) tend to give a higher rating on their instructor's teaching effectiveness. We find students with a stronger record of academic achievement, measured by a higher cumulative GPA, tend to give a higher rating on instructor's teaching effectiveness. Additionally, the data show that students who are enrolled simultaneously in more courses (NumClass) tend to give lower ratings on instructor's teaching effectiveness.

In the second column of Table 3, we show the differing impact between blended and FtF courses on the intensity of students' usage of study groups (StudyGroup) in enhancing their learning experience. We find that blended course students tend to use study groups more than those in FtF courses. This finding supports our second hypothesis (H2) that students in blended courses tend to rely more on their peers (social presence) to enhance their learning experience. Our finding is also consistent with findings from recent studies that indicate a significant difference in social presence experience between blended and FtF courses (Poelmans and Wessa 2015; Szeto and Cheng 2016). We also find that students who watch pre-lecture videos more frequently (Frequency) tend to use study groups more often, while students who consider the screencast videos (Screencast) as more effective learning tools tend to use study groups less often.

The last two columns of Table 3 show the impact of different class formats (i.e., blended versus FtF ) on students' midterm exam and expected course grades. We find that students in blended courses actually perform better academically (i.e., higher midterm exam and expected course grades) than students in FtF courses. The result provides support for our third hypothesis (H3), that students in blended courses tend to experience different (higher) levels of learning outcomes than students in FtF courses. We included students' cumulative GPA as a control variable to represent their academic aptitude and find that students' academic aptitude is positively related to their midterm exam grade and their expected course grade. We also find that international students tend to perform better than domestic students.

Since students may self-select to enroll in a blended course rather than a FtF course, we address the potential self-selection bias by employing the Heckman (1979) two-step regression process. In the first stage, we performed probit regression to determine the likelihood of a student enrolling in a blended course and used the inverse-mills ratio from the first stage regression as an additional independent variable in the second stage regression for teaching effectiveness, study group, and student achievements (midterm exam and expected grades). We used two instrumental variables to determine the likelihood of a student to enroll in a blended course: (1) students' perception that YouTube videos can replace FtF lectures (YouTubeReplace) and (2) students' perception that screencast videos can replace FtF lectures (ScreencastReplace). We believe that these two variables represent students' learning preferences (self-selection bias) toward online learning environments. We also included age, gender, work experience, and understanding of the flipped lecture format, as control variables in our first stage regression. The first stage probit regression result is presented in the last column of Table 4. We find that older students are less likely to enroll in a blended course. One explanation is that older students find adapting to online learning environments (including adapting to the technology for online learning) to be more difficult than younger students. We find that students with higher work experience are more likely to enroll in a blended course due to their work schedules. Female students also tend to enroll more in a blended course. More importantly, we find that one of our instrumental variables, students' perception that YouTube videos can replace FtF lectures, is positively related with enrolling in a blended course.

Our second stage regression results are presented in the first four columns of Table 4. First, we find that the slopes of the inverse-mills ratio are statistically significant (except for teaching effectiveness). This indicates that there is a sample selection bias and that we were able to control for the self-selection bias. More importantly, we find that the results after controlling for sample selection bias (Table 4) are similar with the results presented in Table 3.

Table 4: Heckman Two-Step Regression

|  | Second Stage | Second Stage | Second Stage | Second Stage | First Stage |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Teaching | Study | Midterm | Expect | Prob(Blended) |
|  | Effectiveness | Group | Exam | Grade | Regression |
| Blended | -0.4880 | 1.0771 | 3.9764 | 0.2652 |  |
|  | (2.41)** | (4.20)*** | (2.41)** | (2.78)*** |  |
| Frequency | -0.0013 | 0.2815 | -0.5553 | -0.0176 |  |
|  | (0.01) | (1.88)* | (0.89) | (0.39) |  |
| YouTube | -0.0075 | 0.0309 | 0.1362 | 0.0206 |  |
|  | (0.23) | (0.43) | (0.32) | (1.20) |  |
| Screencast | 0.0474 | -0.1319 | 0.0839 | 0.0080 |  |
|  | (1.60) | (2.49)** | (0.24) | (0.45) |  |
| HWQuizGrade | 0.2187 | 0.0530 | 1.8162 | 0.0677 |  |
|  | (2.75)** | (0.47) | (1.71) | (1.89)* |  |
| Flipped | 0.0325 | 0.0898 | -0.5285 | -0.0133 | 0.0448 |
|  | (1.23) | (1.36) | (0.82) | (0.43) | (0.91) |
| Hourstudy | -0.0149 | 0.0063 | 0.0422 | 0.0032 |  |
|  | (1.55) | (0.23) | (0.29) | (0.43) |  |
| CumGPA | 0.5249 | -0.5509 | 13.8375 | 0.5755 |  |
|  | (3.63)*** | (1.72) | (5.03)*** | (4.77)*** |  |
| NumClass | -0.0043 | 0.0523 | -1.0326 | -0.0204 |  |
|  | (0.07) | (0.46) | (0.99) | (0.81) |  |
| Undergrad | -0.0327 | 0.0164 | 0.1494 | 0.0212 |  |
|  | (1.79) | (0.46) | (0.54) | (0.92) |  |
| Age | 0.0156 | -0.0134 | 0.1776 | -0.0098 | $-0.1423$ |
|  | (0.86) | (0.27) | (0.43) | (0.59) | (3.44)*** |
| Gender | 0.0193 | 0.0267 | 0.3472 | 0.0265 | 0.6909 |
|  | (0.36) | (0.27) | (0.40) | (0.66) | (1.82)* |
| International | 0.2311 | $0.1606$ | 3.8052 | 0.4576 |  |
|  | (2.30)** | $(1.29)$ | (2.80)** | (9.17)*** |  |
| WorkExperience | 0.0001 | -0.0231 | -0.1964 | 0.0186 | 0.3213 |
|  | (0.00) | (0.43) | (0.49) | (0.95) | (4.06)*** |
| LikeClass | 0.0170 | -0.1698 | 0.6770 | 0.0129 |  |
|  | (0.14) | (0.80) | (0.58) | (0.28) |  |
| LikeVideo | 0.0980 | 0.0540 | 1.8220 | 0.1731 |  |
|  | (0.74) | (0.22) | (1.89)* | (2.52)** |  |
| YouTubeReplace |  |  |  |  | 0.3518 |
|  |  |  |  |  | $(2.06)^{* *}$ |
| ScreencastReplace |  |  |  |  | 0.0128 |
|  |  |  |  |  | (0.14) |
| Intercept | 1.2406 | 3.7772 | 24.6464 | 1.0624 | -0.0929 |
|  | (1.43) | (2.10)* | (1.73) | (1.51) | (0.14) |
| Inverse-Mills | -0.0024 | -0.0180 | -0.0526 | -0.0056 | - |
| Ratio | (0.94) | (2.88)** | (2.14)* | (3.90)*** | - |
| Number of |  |  |  |  |  |
| Adj. R-squared | 0.2488 | 0.1967 | 0.2397 | 0.3105 | 0.3964 |

YouTube and Screencast variables are based on the question 4 of Appendix B to control for the delivery methods of asynchronous prelecture videos. YouTubeReplace and ScreencastReplace variables are based on the question 5 of Appendix 5 and act as instrumental variables for students' preference of blended relative to FtF modality. Robust t statistics in parentheses with clustered standard errors by each class section. * significant at $10 \% ; * *$ significant at $5 \% ; * * *$ significant at $1 \%$. Pseudo R -squared is reported in the first stage regression. See Appendix C for variable descriptions.

## Conclusions

The blended course format, which is a mix of in-person, face-to-face and online classes, is becoming more popular among universities as a method of delivering course content. Our study seeks to contribute to a better understanding of the dynamics of teaching and social presence, as well as the relationship between teaching modalities and student academic performance, by examining the differences in student learning experience between blended versus traditional FtF formats in a finance course. Extant literature indicates that due to reduced face-to-face class time between instructors and students, the blended course format provides less direct instruction, personal attention, assistance, and social cues from both instructors and students (Garrison and Kanuka 2004; Laurillard 1993; Lim and Kim 2003).

Using the CoI framework (Garrison et al. 2000), we hypothesized that students in blended courses would perceive and experience lower teaching presence than in FtF courses, which in turn would translate into lower ratings on teaching effectiveness. We also hypothesized that students in blended courses would tend to utilize more social presence (learning from their peers through a study group) than in FtF courses. Additionally, we hypothesized that student learning outcomes would be significantly impacted by the different course formats

To test our hypotheses, we examined students' perception of the effectiveness of the course and the instructor utilizing two datasets: students' end-of-semester course evaluations and student surveys from the middle of the semester. Our results showed that students' perceptions on course and teaching effectiveness (teaching presence) were significantly lower in blended courses than in FtF courses. Our results also showed that students in blended courses tend to rely more on study groups (social presence) to enhance their learning experience than in FtF courses. Finally, we found evidence that students in blended courses tend to have higher learning outcomes (cognitive presence measured by midterm exam and expected grades) than students in FtF courses. Our empirical findings proved robust after controlling for self-selection bias.

Our study offers two important implications. First, the traditional FtF course evaluation questionnaires may not be appropriate for blended courses, as they tend to produce significantly lower teaching evaluation scores even for the same course taught by the same instructor. Hence, there is a need for a paradigm shift at the institutional level in evaluating instructors' teaching effectiveness for blended courses. Second, given that students in blended courses have less interaction with their instructors (i.e., lower teaching presence), it is crucial for instructors in blended courses to promote and to facilitate an increased level of collaborative learning among students (social presence). Our study revealed that students in blended courses do have the potential to achieve higher learning outcomes, in terms of higher grades, than students in FtF courses.

We acknowledge several possible limitations to our study. First, due to the technology-intensive nature of the online learning environment for blended courses, it is possible that there were differences in the instructor's tone and emphasis in communicating course goals and expectation in the first day of class between blended and FtF courses. The differences in emphasis, including the time allocated in outlining the course structure, may have influenced students' perceptions on the blended course goals and objectives (questionnaire C 1 ) and assignments (questionnaire C 2 ). Second, we were unable to control for other possible factors that are not contained in or captured by the questionnaires, which may have influenced students' preference in choosing blended versus FtF formats. Finally, the class sample size varied among blended and FtF courses. Therefore, the number of observations for the blended format was significantly smaller than for the FtF format, which may have influenced our results. We believe further studies with larger sample sizes and across multiple courses and disciplines would show additional insights in the differences and similarities between blended and fully FtF course formats.

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## APPENDIX A <br> Course Evaluation Questionnaire (End of Semester)

C1) Goals and objectives of this course were clearly stated.
C2) Course assignments/requirements were clearly defined.
C3) Course had relevant readings/textbooks/assignments.
C4) Course time was spent on relevant and important material or activities.
C5) Course increased my knowledge of subject matter.
C6) Course was intellectually challenging.
I1) Instructor presented content in an informative way.
I2) Instructor increased my interest in the subject matter.
I3) Instructor provided useful feedback to students.
I4) Instructor clearly defined his/her methods of evaluating students.
I5) Instructor was well-prepared for class.
I6) Instructor encouraged expression of diverse viewpoints.
I7) Instructor integrated practical applications into the course.
I8) Instructor effectively monitored students' understanding of the subject matter.
I9) Instructor displayed caring and sensitivity toward students.
I10) Instructor assigned work which required critical thinking.
I11) Instructor encouraged respect for professional ethics and moral values.
I12) OVERALL, THE COURSE INSTRUCTOR WAS AN EFFECTIVE TEACHER.

Each Questionnaire (C1 through I12) has the following drop-down choices:
C Strongly Agree (5)

- Agree (4)

C Undecided (3)

- Disagree (2)

C Strongly Disagree (1)

- Not Applicable/Observed (n/a)


## APPENDIX B Mid-Semester Survey Questionnaire

1. Have you ever watched pre-lecture videos? (Circle Yes or No)
2. On average, how many times did you watch EACH pre-lecture VIDEO?
3. From 6 (six) different learning methods below, please rank from (1)=Best to (6)=Worst method that facilitates your learning effectively: (Please Write Your Ranking from 1 to 6)

| Delivery Methods: | Your Ranking |
| :--- | :--- |
| In class face-to-face lecture using PowerPoint slides |  |
| In class face-to-face lecture using whiteboards \& markers |  |
| Screencast pre-lecture with handwriting videos |  |
| Reading the textbook by yourself |  |
| YouTube pre-lecture videos with instructor in it |  |
| Others (i.e. discussion board, study group, chat room, <br> video conferencing, etc. State One): |  |

4. Using the scale (1) Most Effective to (5) Very Ineffective, which of the following helped you learn and understand the class contents:

|  | Most <br> Effective | Effective | Neutral | Ineffective | Very <br> Ineffective |
| :--- | :---: | :---: | :---: | :---: | :---: |
| YouTube pre-lecture videos | 1 | 2 | 3 | 4 | 5 |
| Screencast with handwriting videos | 1 | 2 | 3 | 4 | 5 |

5. Using the scale of (1) Strongly Agree to (5) Strongly Disagree, what do you think of the followings:

|  | Strongly <br> Agree | Agree | Neutral | Disagree | Strongly <br> Disagree |
| :--- | :---: | :---: | :---: | :---: | :---: |
| YouTube videos as a substitute for an in class lecture <br> Screencast Handwriting videos as a substitute for in <br> class lecture | 1 | 2 | 3 | 4 | 5 |
| YouTube videos helped you to earn a better grade | 1 | 2 | 3 | 4 | 5 |
| Screencast Handwriting videos helped you to earn a <br> better grade | 1 | 2 | 3 | 4 | 5 |
| Homework \& practice quizzes helped you to earn a <br> better grade | 1 | 2 | 3 | 4 | 5 |
| Your current FINC614/FINC655 class is a flipped <br> lecture class | 1 | 2 | 3 | 4 | 5 |

6. How many Hours Per Week did you spend to study for this FINC655.35FL course?
7. How many Hours Per Week do you think you should spend to succeed in this FINC655.35FL course?
8. How often do you do a study group? (Circle one) (1) Very Often (2) Often (3) Normal (4) Not Often (5) Never
9. Your Current Cumulative GPA in the program and your undergrad GPA:

Current GPA.
Undergrad. GPA $\qquad$
10. How many classes are you currently taking concurrently this semester:
11. Your Undergraduate Major (Circle one):
(1) Arts/Language
(2) Science
(3) Math/Statistics
(4) Engineering
(5) Business/Econ
(6) Other (State):
12. Your Age:
13. Gender (Circle Female or Male): (1) Female or (2) Male
14. Are you an International Student (Circle Yes or No): Yes or No
15. Number of Years of Work Experience:
16. Your Midterm Exam Grade in this FINC655.35FL (in \%, i.e., $60 \%$ is 60 ):
17. Your Expected Grade in this FINC655.35FL (in Letter Grade A, B):
18. How do you rate the effectiveness of instructional process in this FINC655.35FL class? (Circle One)
(1) Very Effective; (2) Effective;
(3) Neutral;
(4) NOT Effective
(5) Very Ineffective
19. Do you like the class?
(1) Yes (2) No
20. Do you like the pre-lecture videos?
(1) Yes (2) No
21. Write your additional comments here (i.e., Why do you watch/not watch the pre-lecture videos):

| APPENDIX C |  |  |
| :---: | :---: | :---: |
| No. | Variables | Descriptions |
|  | Blended | An indicator variable equals to one if the course was taught in blended format and zero if the course was taught in FtF format |
| 2 | Frequency | How many times students watched each pre-lecture video |
| 5 | HwQuizGrade | Perception that homework, exercises, and practice quizzes help them to earn a better grade |
| 5 | Flipped | Perception that their current class is considered as a "flipped lecture" class |
| 5 | YouTubereplace | Perception that YouTube videos can replace (act as a substitute for) FtF class lecture |
| 5 | Screencastreplace | Perception that Screencast videos can replace (act as a substitute for) FtF class lecture |
| 6 | Hourstudy | Number of hours students spent to study for this finance class per week |
| 7 | Reqhourstudy | Number of hours students believe they should spend to study for this finance class per week |
| 8 | Studygroup | How often students engaged in study group with their classmates |
| 9 | CumGPA | Students' current cumulative grade point average (GPA) in the program |
| 10 | NumClass | Number of classes students are concurrently taking including this finance class |
| 11 | Undergrad | Students' undergraduate majors (Art/Language, Science, Math/Stats, Engineering, Business/Econ, or Other) |
| 12 | Age | Students' current age |
| 13 | Female (gender) | Students' gender equals one if students are female and zero otherwise |
| 14 | International | Whether students are international students (equals one) or not (equals zero) |
| 15 | WorkExperience | Number of years of students' work experience |
| 16 | Midterm Exam | Midterm exam grades that students received |
| 17 | Expected Grade | Students' expectation of their course grades at the end of the semester |
| 18 | Teaching Effectiveness | Rating on teacher/instructor effectiveness from (1) very ineffective to (5) very effective |
| 19 | LikeClass | Whether students like the class (equals one) or not (equals zero) to measure students' personal preference or biases toward their current finance class/instructor |
| 20 | LikeVideo | Whether students like the pre-lecture videos (equals one) or not (equals zero) to measure students' personal preference or biases toward the pre-lecture videos |

No. corresponds to the numbers on Mid-Semester Survey Questionnaire presented in Appendix B.

# The Economics of Breaking Bad: A Concept Guide 

Daniel Duncan, Steve Muchiri, and Mihai Paraschiv ${ }^{1}$


#### Abstract

This work complements and refreshes the current stock of pedagogical resources by exploring the economic principles that can be taught using the popular television series Breaking Bad. We perform an exhaustive examination of the entire series and document precise instances that illustrate key economic concepts. This resource provides the instructor with the opportunity to teach economic concepts using content that caters directly to students' interests and their affinity for all things pop culture. To facilitate the use of these resources, we also present a number of assignments and assessment questions that can be constructed based on the scenes we identify.


## Introduction

As educators, we cannot deny that striking parallels exist between a successful classroom experience and the creation of a hit television show. Both require that we quickly engage the audience and hold its interest over the course of a semester or season. In both instances, we are competing against a seemingly infinite number of other things vying for our listeners' attention. The key to success in both instances is forging a strong connection with the audience, one that motivates it to attend the next class or watch the next episode. Indeed, a paper by Gehlbach et al. (2016) suggests that teachers who convey to their students that they share common interests, improve student-teacher relationships and grades, and possibly bridge the performance gap for "underachieving" students. In addition, Lang (2016) also highlights the importance of meaningful teacher-student interactions with respect to learning outcomes.

In economics, especially in principles courses, teaching resources that connect educators and students are becoming less difficult to find. Recent efforts in this direction document economic concepts that appear in dialogues and scenes of popular TV shows. These include The Big Bang Theory (Tierney et al. 2016), Shark Tank (Acchiardo et al. 2015), Parks and Recreation (Conaway and Clark 2015), ESPN's 30 for 30 (Al-Bahrani and Patel 2015), The Office (Kuester et al. 2014), The Simpsons (Hall 2014 and Luccasen and Thomas 2010), Seinfeld (Ghent et al. 2011), and multiple other television shows (Mateer et al. 2011 and Mateer and Stephenson 2011).

Even though such resources are becoming increasingly available, there is ample room for this literature strand to expand. Indeed, a survey by Al-Bahrani et al. (2016) finds that, despite ranking at the top of students' preferences, television series such as Breaking Bad, Grey's Anatomy, and Friends do not benefit from an all-encompassing resource designed to document the economics within the show. The present work closes this gap by (i) linking the dialogues and scenes within Breaking Bad with a wide array of economic concepts, (ii) categorizing the accompanying video clips within two, easy-to-navigate tables, and (iii) showcasing a number of sample assignments, questions, and grading rubrics that transform the video clips into methods of assessment and concept verification. The resource introduced here may also serve instructors of criminology classes that focus on criminal behavior and the economic factors behind it or economics courses that focus exclusively on crime or illegal drugs. The need for a Breaking Bad-based teaching resource becomes even more acute when taking into account the show's popularity and its direct appeal to undergraduate students (Al-Bahrani et al. 2016; Al-Bahrani and Patel 2015; Berk 2009; Harter

[^2]2003; and Hoyt 2003). Currently, statistics provided by the Internet Movie Database (IMDB) show that Breaking Bad received its highest ratings from males and females under eighteen and between eighteen and twenty-nine years of age, precisely the age group in which most of our undergraduate students fall. Moreover, Breaking Bad ranks fifth in IMDB's Top 250 TV Shows ${ }^{2}$ and second among one hundred shows reviewed by The Hollywood Reporter. ${ }^{3}$ In this regard, the current work not only expands but also refreshes the stock of resources available to educators who prefer to go beyond the traditional "chalk-and-talk" and enhance the delivery of economics concepts. After all, the shelf life of any such resource depends upon it remaining meaningful in the pop-culture lexicon.

The remainder of the paper proceeds by describing how instructors can use Breaking Bad as a teaching and learning tool. The discussion is followed by a brief overview of the television series Breaking Bad along with an argument that supports the series's cultural relevance and why video clips from Breaking Bad resonate with today's students. Next, the paper provides detailed descriptions of eight video clips that one can use to teach economic concepts. Finally, a set of concluding remarks is provided.

## Using Breaking Bad in Your Course

Besides its popularity and appeal to students' interests, we believe that the attractiveness of a teaching resource is defined by its relative ease of use. However, and unlike some of the TV series mentioned in the previous section, the use of Breaking Bad for illustrating economics concepts may require prior knowledge about the series' plot and characters. We, therefore, recommend that instructors become familiar with the series and provide students with sufficient background information about the content (i.e., video clip) that they plan to use. In order to facilitate this process, we provide brief descriptions of each video clip and/or the dialogue in Appendix A. In addition, synopses of each episode, season, and the entire Breaking Bad series are available online and can easily be used to enhance instructors' familiarity with the series. ${ }^{4}$ Nevertheless, the video clips that we identify require only general familiarity with the series and are rather short. In this regard, the clips are useful for implementing a number of small-teaching techniques that promote active learning, which is known to facilitate long-term concept retention and learning (Lang 2016 and Brown et al. 2014), or facilitate the introduction of economic models such as the Becker (1968) model of criminal behavior. ${ }^{5}$

Lang (2016) writes that small-teaching approaches may take the form of (1) brief (5- to 10-minute) classroom or online learning activities, (2) one-time interventions in the course, and (3) small course-design modifications or changes in communication with students. This paper caters directly to the first two categories. First, the video clips presented here may serve to introduce, summarize, and reinforce key economic concepts. In addition, the clips represent powerful catalysts for think-pair-share activities, selfexplanation exercises, in-class discussions, and polling sessions that rely on the use of classroom response systems (CRSs). Second, video clips are ideal for breaking down a long course and refocusing students' attention onto the material or for implementing one-time (per class or week) activities that may include short/long in-class/out-of-class written assignments or discussions.

We believe that the scope of the paper can be significantly broadened if the resources that are presented within are integrated not only with the in-class component of the course, as lecture-enhancing examples, but also as assignments and assessment questions that require a lengthier and more rigorous analysis from students. To support this, and for select video clips, several multiple-choice questions and written assignments, along with possible responses and accompanying rubrics, are provided in Appendix B. As per Bloom's taxonomy (Bloom 1956), these assess reasoning skills such as knowledge, comprehension,

[^3]application, and analysis. On one hand, teaching using CRSs facilitates student-teacher interaction (Calhoun and Mateer 2012), fosters peer-instruction and self-explanation as learning techniques (Lang 2016), and increases student engagement (Salemi 2009). On the other hand, writing assignments or discussion threads are excellent tools for giving students the chance to expand their knowledge and to connect concepts with each other or with the outside world (Lang 2016).

There are, of course, many other ways of incorporating visual media into the classroom. In this regard, we do invite the reader to explore the multitude of alternative uses via Starting Point: Teaching and Learning Economics, ${ }^{6}$ which represents an excellent initiation resource.

## Breaking Bad

Breaking Bad is a cable drama series that tells the story of Walter White who, after being diagnosed with lung cancer, slowly morphs from a mild-mannered high school chemistry teacher into a methamphetamine-producing kingpin. Along the way, the audience witnesses how his transformation not only affects himself, but also the people around him. The show ran for five seasons between 2008 and 2013, has been hailed by critics ${ }^{7}$ as one of the best shows of all time, and won the Primetime Emmy award for outstanding drama series twice. The actor, Brian Cranston, who plays Walter White, won the Primetime Emmy for outstanding lead actor in a drama series four times. Aaron Paul, who played the supporting character Jesse Pinkman, won the Primetime Emmy for best supporting actor in a drama series three times. These awards are just a small fraction of the accolades heaped upon the series, but they clearly illustrate the quality and popularity of the show in and of itself.

During its television run and afterwards through subscription streaming platforms such as Netflix and other content-delivery systems, Breaking Bad has grown from just a highly praised show into a cultural phenomenon. The show's place in the pop culture hall of fame has made facts about the show generally accepted common knowledge in our society. It appears that even people who have never watched a single episode are aware of the show and have a general semblance of what it is about. Breaking Bad has even been known to inspire the study of contexts, politics, and style within the series (e.g., Pierson 2013). To understand how popular and addicting the show can be, one needs only to examine a recent data release from Netflix pointing out that, between January and July of 2015 , $70 \%$ of the viewers who watched only the first two episodes completed the entire series. Among the shows analyzed, Breaking Bad tied for the earliest episode after which the average viewer was drawn into the series. Pairing these findings with the show's overall popularity, subject matter, and cultural relevance, we believe that the use of examples from this series resonate very well with today's economics students.

## Clips and the Associated Economics Concepts

Breaking Bad offers a plethora of scenes that can be used to provide real-world examples of economic concepts that frequently appear in principles-level courses. Following the layout of Al-Bahrani and Patel (2015), we discuss a number of video clips along with the concepts nested within. In what follows, season and episode numbers, episode title, as well as the start and end times identify the video clips. The listing is by no means complete and, in this regard, we invite the reader to consult Tables A1 and A2 in Appendix A.

Season 1, Episode 1 "Pilot" (Netflix Time: 27:34-30:07); Concepts: Absolute Advantage; Comparative Advantage; Specialization; Division of Labor; Gains from Trade; Incentives; Game Theory; Ultimatum Game

In this clip, Walter tracks down his former student, Jesse, with the intention of collaborating with him in the production of methamphetamine. Walter's intentions become obvious once he starts revealing that the Drug Enforcement Agency (DEA) has apprehended Jesse's business associate. Walter goes further and

[^4]adds, "But you know the business and I know the chemistry. I'm thinking ... maybe you and I could partner up." This scene can motivate a conversation about comparative advantage-based specialization. While Jesse has performed both tasks in the past, there is little doubt that Walter, because of his chemistry knowledge and perhaps better task-management skills, is more productive at making methamphetamine as well as distributing/selling it. However, even in the scenario in which Walter has absolute advantage in both cooking and distributing methamphetamine, the logic of comparative advantage tells us that Walter and Jesse should collaborate. More specifically, Walter should cook while Jesse should distribute/sell the methamphetamine. This is simply because Walter's opportunity cost of distributing/selling is time that he could spend cooking and, therefore, a relatively large amount of methamphetamine he could produce instead. Conversely, and by the same logic, Jesse's opportunity cost of distributing/selling methamphetamine is lower than Walter's. In sum, David Ricardo tells us that Walter should cook while Jesse should hit the streets, even if Walter is better (more productive) at both. Finally, the instructor can link the two with a discussion about the gains from trade. One question could be whether the United States has absolute advantage over some of the products it imports and why aren't these goods produced locally.

Incentives, and how individuals respond to incentives, represent another key economics concept. In this clip, Walter's offer for a partnership deal comes with a catch. Jesse: "You wanna cook crystal meth? You. You and me." Walter: "That's right. Either that, or I turn you in." Walter threatens to inform the DEA about the methamphetamine business if Jesse chooses not to join the partnership. Here, Walter is encouraging some action (joining him) by issuing a threat (turning Jesse in). Their interaction represents an ultimatum game, in which Walter's threat is an example of a negative incentive (i.e., the stick).

Season 1, Episode 1 "Pilot" (31:54-33:54); Concepts: Product Differentiation; Branding; Monopolistic Competition; Market Power; Elasticity of Demand; Utility

This clip shows Walter's preference for producing superior products. In an inspired scene, Walter states: "You and I will not make garbage products. We will produce a chemically pure and stable product. One that performs as advertised. No adulterants. No baby formula. No chili powder." Why should Walter care about how his product performs? Why should product quality matter, especially when traded in a black market characterized by a relatively inelastic demand? Product differentiation and quality, customer satisfaction, monopolistic competition, and market power can all be discussed using this scene. As the show progresses, for example, viewers learn that Walter's product is the best in the market, highly sought after, and blue. This last characteristic is especially important when learning about the white-colored competing methamphetamine. Here, instructors can discuss how product characteristics shape its substitutability and determine the elasticity of its demand or why brand-name products are often priced differently from generic products. A natural question for students can be whether businesses leverage their product superiority by charging a higher price. The discussion can be carried forward to formal markets, especially those involving services, where products are almost identical and customer satisfaction as well as return business are highly regarded.

Season 3, Episode 2 "Caballo Sin Nombre" (30:40-33:36); Concepts: Asymmetric Information; Product Differentiation; Product Characteristics; Profit-maximizing Behavior, Opportunity Costs; Economizing Behavior

This video clip pits the controversial lawyer Saul Goodman against a couple, who want to sell their house, and their counselor, Mr. Gardiner. Negotiations start and seem to unfold well until the parties disagree about the selling price. The couple asks for $\$ 875,000$ but Saul, on behalf of his client, offers only $\$ 400,000$. The couple and their counselor are offended by the offer and, while mentioning that the meeting was a complete waste of their time, start walking out of the room. They stop once Saul mentions the methamphetamine laboratory that used to be in the basement. This unpleasant but key attribute is purposefully hidden from the buyer to keep up the value of the house. However, in this case, the prospective buyer seems to have done his homework. Unfortunately, in many transactions, the information held by sellers is not available to buyers and vice versa. In cases where such information gaps persist and are systematic, markets unravel and, ultimately, fail.

Also, note that upon introducing himself, one of the sellers immediately recognizes Saul as "the lawyer on late-night television." This is because of his catchphrase "Better Call Saul," which is present in all ads involving his business. Product/service differentiation is a key feature of markets in which many of
today's sellers and buyers interact. Together, these traits outline some characteristics of monopolistically competitive markets.

Finally, it is worth mentioning that Mr. Gardiner, the couple's counselor, is ardent to get right to business. This leads Saul to remark, "I get it. Flat-fee clients, am I right?" This arrangement incentivizes Mr. Gardiner to service his clients as fast as possible and therefore maximize his hourly pay. The more time he spends with his clients, the lower his hourly pay (since it is a flat charge), and the higher his opportunity cost.

Season 3, Episode 5 "Mas" (42:08-43:31); Concepts: Monopsony; Market Power; Bargaining Power; Transaction Costs; Willingness to Supply; Producer Surplus; Willingness to Pay; Consumer Surplus; Elasticity of Supply; Contracts; Contract Enforcement; Role of Institutions; Dispute Resolution

The video clip brings us into the office of Saul Goodman, where Walter and Jesse try to sort out some of their recent misunderstandings. In the process, Jesse finds out that Walter is soon to start "cooking" (producing) methamphetamine without him and under the employment of their associate, Gus Fring. When Walter is asked about how much he stands to gain from this new partnership, he simply responds, "It is \$3 million, for three months of my time." Saul knows that this large amount of money needs to be "laundered" and immediately offers his services for a $15 \%$ fee. However, as a prospective customer for moneylaundering services, Walter is well aware of his bargaining power and quickly counters Saul's offer with a $5 \%$ fee. Saul attempts to negotiate a high-enough fee by sequentially proposing $14 \%, 13 \%, 12 \%$, and $10 \%$ fees. In each scenario, Walter's response is unchanged, " $5 \%$." Single buyers, or monopsonists, have the market power to reduce the acquisition price, just as a monopolist has the market power to limit the quantity supplied and therefore increase market price to maximize profits.

This video clip is also instructive about the price elasticity of supply. More specifically, the video clip emphasizes Saul's perfectly inelastic supply for money-laundering services over the observed range of prices (i.e., $5 \%$ to $15 \%$ ). Despite the fact that the laundering fee (the price Saul receives) is adjusted from $15 \%, 14 \%, 13 \%, 12 \%$, to $10 \%$, and finally to $5 \%$, Saul is still willing to supply his services. The negotiation between Walter and Saul also reveals some information about Saul's "willingness to supply," which seems to be somewhere under or at the $5 \%$ threshold. This is simply because even at $5 \%$, Saul accepts the proposal.

Finally, yet importantly, the dialogue between Jesse and Walter, which is located at the end of the video clip and included below, may be used to frame a discussion about contracts, contract enforcement, and the role of institutions in shaping the behavior of economic agents. Jesse: "You think that this will stop me from cooking?" Walter: "Cook whatever you like. As long as it's that ridiculous Chili P or some other dreck ... but don't even think about using my formula." Jesse: "Just try and stop me!'" While Walter is indeed the one who discovered the formula for the "blue" methamphetamine, he might have a hard time preventing Jesse from using the same formula in his pursuit of producing a similar good. Had this formula involved any other legal product, such a dispute would have been prevented by the filing of a patent or by a contract regarding its use, both of which would be enforceable through a functioning judicial system. However, the use of institutions as a dispute-settling mechanism is not possible in this case - methamphetamine is an illegal good, produced and consumed within a black market. Consequently, violence and the use of force tend to replace institutions in solving such issues, a substitution that generates significant external costs to society.

Season 3, Episode 9 "Kafkaesque" (00:00-02:27); Concepts: Total Costs; Fixed Costs; Variable Costs; Principal-Agent Contract; Monitoring; Shirking; Underground Economy

This scene begins with a commercial for a restaurant called Los Pollos Hermanos, but transitions into a montage of how the owner of the restaurant chain is actually at the head of a giant methamphetamine manufacturing and distribution operation. One can see the methamphetamine being produced, packaged, distributed, and how the restaurant's facilities and trucks are used to further the drug trade. Throughout the clip, different inputs are used in the manufacturing and distribution of methamphetamine. In this particular instance, the costs with inputs such as labor, weighting scales, plastic and glass containers, trucks, and facilities are fixed. On the other hand, the costs associated with the plastic bags, in which the drug is sealed, and the invisible ink used to mark the buckets containing the product are examples of variable costs.

The video clip is also helpful for discussing the principal-agent contract. More specifically, the clip presents Gus Fring as he supervises the packaging and loading of methamphetamine into trucks for distribution purposes. The owner of Los Pollos Hermanos, Gus, is the man running the methamphetamine production operation and, in this case, the principal. The laborers packaging the methamphetamine and the truck drivers transporting it are the agents. Sometimes agents do not act in the principal's best interest. This behavior is also known as shirking and can be prevented or limited through adequate monitoring activities, which is precisely what Gus does.

Season 3, Episode 12 "Half Measures" (09:06-14:52); Concepts: Costs/Unintended Consequences of Illegal Drugs; Human Capital; Poverty; Restricted Opportunity; Social Mobility; Monopolistic Competition; Black Markets; Contract Enforcement; Dispute Resolution; Judicial System; Role of Institutions; Production Possibility Frontier

The scene brings forward a discussion between Jesse and Walter. Their dialogue centers on how their competitors choose to protect their turf and on the shooting of their partner, Combo, for which Jesse seeks revenge. First, the scenes within the video clip are particularly useful for discussing the importance of property rights and dispute-settlement mechanisms that are delivered by a functioning legal system. Second, the scenes are also useful for discussing the consequences brought about by the impossibility of property rights/contract enforcement in markets for illicit goods (e.g., drugs). For example, when Combo sells "blue" methamphetamine in the competitors' turf he ends up being killed by an 11-year-old boy. The rival gang seizes and sells the "blue" methamphetamine, distributed by Combo and cooked by Walter and Jesse, as their own. Outside of black markets, courts or specialized branches of the police would have handled such disputes. However, when the rule of law and property rights are absent, vaguely defined, or not enforceable, agents resort to other means of enforcement such as violence, which breeds more violence - Jesse is obviously seeking revenge for Combo's death.

The clip is also useful for illustrating the socio-economic costs and the unintended consequences of illegal drugs and the black markets that form in response. The loss of life and the use of children, often from poor neighborhoods and low-income families, as labor are obvious. A discussion about social mobility and human capital development may also originate within these scenes. In broad terms, children who end up dealing drugs and protecting turfs fail to accumulate the much-needed human capital, which should allow them to fare better than their parents. The scenes within may also be used to discuss how failure to accumulate human capital or make meaningful investments in tomorrow's labor force diminishes a jurisdiction's ability to produce goods and services, or, in other words, shifts that jurisdiction's production possibility frontier inward.

Season 4, Episode 1 "Box Cutter" (01:41- 04:30); Concepts: Product Differentiation; Monopolistic Competition; Alchian-Allen Effect in Prohibited Drugs; Potency Effect; Substitutes in Consumption and Production; Cross-Price Elasticity of Demand; Marginal Cost vs. Marginal Benefit

This scene brings forward a dialogue between Gus Fring and Gale Boetticher, a German-American chemist hired by Gus, about the purity of methamphetamine. Gus: "After all, how pure can pure be?" Gale: "Well, it can be pretty darn pure. Mr. Fring, I can guarantee you a purity of 96\%. I am proud of that figure. It is a hard-earned figure, 96. However, this other product [cooked by Walter] is $99 \%$. Maybe even a touch beyond that. I need an instrument called a glass chromatograph to say for sure but that last $3 \%$... it may not sound like a lot, but it is. It is tremendous. It is a tremendous gulf." Gus: "Gale, for our purposes, $96 \%$ will do just fine."

From here, it is apparent that Gus weighs the costs and benefits of producing $99 \%$ - or $96 \%$-pure methamphetamine. After all, the equipment he just purchased is suited for producing both purities, which makes the two varieties substitutes in production. Nevertheless, Gus decides that a purity of $96 \%$ will suffice. From his perspective, the cost of working with Walter, who is regarded as unprofessional, outweighs the 3-percentage point increase in the purity of the drug. However, Gus' methamphetamine, although $96 \%$ pure, is inferior to Walter's and the logic of the Alchian-Allen theorem tells us that he might be losing out as long as it competes with the "blue" drug. In other words, the Alchian-Allen theorem states that, when the same transportation, distribution, tax, or sale-specific markup is added to the prices of two similar varieties of the same product, the relative consumption of the higher quality good will increase. Since from a legal perspective, the risks and costs of distributing methamphetamine are, more or less, the
same, regardless of its purity, a relatively larger market share will be accounted by Walter's "blue" methamphetamine. The scenes within the video clip are also useful for discussing product differentiation as a key characteristic of monopolistically competitive markets. The blue color of Walter's methamphetamine represents a signal of quality and purity that bridges the seller-buyer information gap, a problem that plagues black markets such as those for drugs and other illicit goods or services.

Season 5, Episode 3 "Hazard Pay" (38:41-44:06); Concepts: Fixed, Variable, Total, and Transaction Costs; Profit; Compensating Differential; Property Rights; Dispute Resolution; Judicial System; Role of Institutions; Underground Economy; Money Laundering; Black Markets; Return to Risk; Gross Domestic Product

This scene shows Walter, Jesse, and their associate, Mike, splitting the proceeds from a new methamphetamine-production business and demonstrates how businesses incur various expenses while providing instructors and students with a lively example about the different types of costs. Once Mike divides the revenue into three equal stacks, he goes on to do an accounting of all the costs they have incurred while producing their latest batch. As he explains, one can observe that some costs, such as the ongoing expense with keeping former collaborators quiet, are fixed, while others, such as the cut to the dealers or the fee for the drug mules (i.e., those who transport the methamphetamine from its production to its distribution location), are variable. Actually seeing each pile of cash shrink, as they account for the costs of the business, provides a visceral example about costs, profit, and the relationship between the two.

This clip may also serve as a catalyst for discussing, once again, the role of institutions in shaping the behavior of economic agents and the consequences brought about by their lack of reach into markets for illicit goods, such as the market for methamphetamine. For example, Walter is surprised to find out that the cost with the mules is $20 \%$ of the revenue. However, Mike adds that transporting the methamphetamine involves risks (i.e., of being robbed by a rival gang or being caught by the police and sent to jail), and the cost is justified - in economics jargon, such costs represent the compensating differential for hazardous work conditions. Outside black markets, a robbery is solved by simply reaching out to the police or other specialized authorities. In other words, property rights may be enforced through the judicial system. However, in the case of methamphetamine, this is not possible. This way, those who move the drug must also guard it and enforce the property rights over it through violence. Hence, the steep cost of transportation that characterizes the methamphetamine-producing business.

This clip also provides a detailed account of various activities that form the underground economy and underpin the $\$ 1,392,800$ methamphetamine business. For example, dealers receive $\$ 13,240$, mules (the ones who transport the methamphetamine for distribution purposes) get a flat $20 \%$ (after the dealers have been paid) or about $\$ 278,560$, miscellaneous production-related expenses total $\$ 120,000$, expenses associated with concealing the laboratory add up to $\$ 165,000$, while the lawyer/money-laundering fees are $\$ 54,000$. As part of the methamphetamine production, all these activities are illegal, thus not recorded officially, and hence part of the underground economy. The figures associated with such activities may find their way into official data, however, as fictional activities/services conjured by money launderers. This illustrates once more the difficulty that arises in trying to accurately measure economic activity, be it as the gross domestic or gross national product.

## Conclusions

Educators are in an endless "competition" for students' attention. In addition, successfully attracting and maintaining the focus of our audiences requires that instructors appeal to students' non-academic or extra-curricular interests. Using popular television shows to connect the "in-class" with the "out-of-class" has a proven track record of reaching students and retaining their attention (Al-Bahrani et al. 2016), all with the added bonus of making the material more interesting and memorable.

We are convinced that the Breaking Bad scenes documented here can aid instructors in getting close to winning this "competition." First, according to the Internet Movie Database (IMDB), the show is widely popular among both males and females below twenty-nine years of age, precisely the age group in which the vast majority of our students fit. This should significantly lower the difficulty of drawing in our audience and maintaining its focus. Second, despite its popularity and unlike other well-known television series, Breaking Bad does not benefit from an accompanying teaching resource. Third, the Breaking Bad
instances that we document cover a vast and comprehensive array of economics concepts and summarize them in two, easy-to-navigate tables. Fourth, to ease the cost of implementation while not digressing from the topic, we are providing a limited set of sample, assessment, and in-class polling questions as well as writing assignments. We, nevertheless, invite instructors to use the instances enumerated in Appendix A to create their own.

There is also potential for building upon the current work. Given the multitude of economics concepts it covers, this paper could serve as a basis for a semester-long "Economics of Breaking Bad" course. However, these and other spin-offs of this work represent the basis for a different set of projects altogether.

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## APPENDIX A

Table A1: Description of Scenes by Season, Episode, and Time

| Episode | Brief Description | Economic Concepts |
| :---: | :---: | :---: |
| Season 1 Episode 1 "Pilot" | Please refer to the description provided within the section titled "Clips and the Associated Economics Concepts". (Netflix Time: 27:34-30:07) | Absolute advantage; comparative advantage; specialization; division of labor; gains from trade; incentives game theory; ultimatum game |
| Season 1 Episode 1 "Pilot" | Please refer to the description provided within the section titled "Clips and the Associated Economics Concepts". (31:54-33:54) | Product differentiation; branding; monopolistic competition; market power; utility; |
| Season 1 Episode 4 "Cancer Man" | Walter: "What's that we are putting on a credit card?" Skyler: "It's just a deposit kind of thing." Walter: "How much of a deposit?" Skyler: "It's \$5,000." Walter: "Five thousand? Jesus! What is that, just to start? I mean ... just to tell me what I already know?" Skyler: "Walter, he [the doctor] is not in our HMO, okay?" (17:0818:53) | Health care concepts (e.g., HMO, PPO) |
| Season 1 Episode 5 "Gray Matter" | This clip shows Jesse taking part in a job interview. Jesse: "And it doesn't really say it here but I have a solid background in sales." Upon telling Jesse that there is a misunderstanding, the hiring manager adds: "I mean, I'd be happy to consider you for a sales position but all our agents need to be licensed, have at least two years on-the-job experience and usually a college degree. What you'll be doing is more like advertising." (00:00-01:20) | Unemployment; job search; general and job-specific human capital; barriers to entry; |
| Season 1 Episode 6 "Crazy Handful of Nothing" | Walter: "How much is this?" Jesse: "26 big ones." Walter: "Is that all, \$26,000?" Jesse: "No, that $\$ 2,600$ and your share is $\$ 1,300$ minus $\$ 25$ for that phone." [...] Walter: "This is unacceptable. I am breaking the law here. This return is too little for the risk." [...] Walter: "We have to move our product in bulk, wholesale. Now, how do we do that?" Jesse: "What do you mean, to a distributor?" Walter: "Yes! Yes, that is what we need. We need a distributor." (15:40-17:25) | Return to risk, production, supply chain; economies of scale; fixed costs; total costs; profit; costsaving middleman; comparative advantage; specialization; division of labor; opportunity cost |
| Season 1 Episode 6 "Crazy Handful of Nothing" | Walter Jr. "Hey, Uncle Hank ... I heard you arrested Mr. Archilleya the other day. He's a pretty cool guy." Hank: "Well, turns out he has a record. Yeah, a couple of possession beefs. We figured he was the guy that was stealing your school's chemistry gear. I mean, you know, he had a key, fit the profile. And, when we searched his truck, we found a big old fat blunt. Which goes to prove old huge Hugo ain't so cool after all." (31:43-34:12) | Correlation is not causation; negative externalities; costs/unintended consequences of illegal drugs |


| Season 1 Episode 7 "A-No-Rough-StuffType Deal" | Walter: "Take a look at that money in your hand. Now, just imagine making that every week. That is right. Two pounds a week, $\$ 35,000$ a pound." Jesse: "Without even talking to me you told this [...] killer that we would give him 2 pounds a week." Walter: "We will just scale up our operation, add a few more hours." Jesse: "No don't talk to me about hours. What about pseudo[ephedrine], man? How are we going to get that? [...] God, it takes me a week to get this stuff." (07:00-08:04) | Resource market, capacity constraints; optimal scale of production; optimal output; profitmotive; incentives; elasticity of supply; underground economy |
| :---: | :---: | :---: |
| Season 1 Episode 7 "A-No-Rough-StuffType Deal" | Tuco: "You told me two pounds and now you waste my time with these Chiclets? $\$ 17,500$. Minus the half for wasting my time." Walter: "Hey, come on." Tuco: "What, are you going to argue?" (11:48-13:07) | Opportunity cost |
| Season 1 Episode 7 "A-No-Rough-StuffType Deal" | Walter: "We are not going to need pseudoephedrine. We are going to make phenyl acetone in a tube furnace and then we are going to use reductive amination to yield methamphetamine, 4 pounds." Jesse: "So no pseudo[ephedrine]?" Walter: "No pseudo." (14:40-15:54) | Substitute inputs; elasticity of supply |
| Season 2 Episode 1 "Seven Thirty-Seven" | In this scene, Walter calculates how much money he needs to raise from producing and selling methamphetamine such that his family's expenses (e.g., college tuition for his two children and mortgage together with other monthly expenses) will be covered after his passing. From an economics perspective, Walter is estimating the expected monetary benefit (or from a different viewpoint, his reservation income) from engaging in an illegal activity. He obviously weighs this expected benefit against the potential costs that come with producing and selling methamphetamine and concludes that eleven more "cooking" sessions is all he needs. (04:24-06:03) | Becker model of criminal behavior; cost-benefit analysis; marginal analysis; inflation; reservation income |
| Season 2 Episode 1 "Seven Thirty-Seven" | Hank: "So, what did they get?" Gomez: "Methylamine, 30 gallons." Hank: "They're cooking old school biker meth." [...] Hank: "Pseudo[ephedrine] is in short supply [shortage] so these two make do by changing the formula. I would say that these two know their chemistry." (23:24-25:06) | Substitute inputs; elasticity of supply |
| $\begin{aligned} & \text { Season } 2 \text { Episode } 2 \\ & \text { "Grilled" } \end{aligned}$ | Tuco: "We'll do nothing but cook 24/7. And no Federales are going to mess with us because I got my people there. Connections." [...] Walter: "Tuco, I have a wife and family." Tuco: "So what? You will get another one!" Walter: "I don't want you to take this the wrong way, but I cannot just ... uproot my life like that." Jesse: "Yeah, man. I mean, me neither." (21:05-21:57) | Subjective cost; opportunity cost; cost-benefit analysis |
| Season 2 Episode 3 "Bit By A Dead Bee" | Jesse: "This stuff [methamphetamine lab ware] has to go, like now." [...] Jesse: "Yo, what did we say, $\$ 500$ ?" Clovis: "We did not say, and it is $\$ 1,000$." Jesse: "A thousand bucks? Come on, where are you towing it, man, to Seattle?" Clovis: "It ain't the miles, it's the cargo." (08:48-12:23) | Inelastic demand; elasticity of demand; willingness to pay; willingness to supply; property rights; incentive effects of private property rights; |


| Season 2 Episode 4 <br> "Down" | Lawyer: "Jesse Bruce Pinkman, pursuant to Section 47-8-13 of the New Mexico Real <br> Property Code you are hereby given notice to vacate the premises listed as 9809 <br> Margo, Albuquerque, 87104." Jesse: "Wait! What? You are kicking me out of my |
| :--- | :--- |
| own house?" Jesse's Dad: "It is your Aunt Ginny's house." Jesse: "And she gave it |  |
| to me." Jesse's Dad: "She never gave it to you, Jesse." Lawyer: "You were allowed |  |
| residentiary privileges. Your parents have been the property owners." (09:22-12:10) |  |$|$

Property rights; incentive effects of private property rights

Elasticity of demand; willingness to pay; willingness to supply; consumer surplus; producer surplus

Elasticity of demand; incentive effects of private property rights; private property

Monopoly; market power; elasticity of demand

Inflation; unemployment; housing market

Intermediate inputs; fixed inputs; variable inputs; specialized inputs; costs; elasticity of supply

| $\begin{aligned} & \text { Season } 2 \text { Episode } 11 \\ & \text { "Mandala" } \end{aligned}$ | In this scene, Skyler (Walter's wife) speaks to Ted Beneke (her employer) about some underreported income, which she found while analyzing the company's records. Initially, Ted labels this as an accounting error but soon admits to underreporting income in an attempt to avoid paying more income taxes. From their conversation, it is clear that Ted purposefully engages in this illegal activity by taking into account the benefits and costs of doing so. The scene is also useful for discussing the decline in tax receipts during a recession as well as its potential causes. (30:50-34:34) | Becker model of criminal behavior; cost-benefit analysis; marginal analysis; tax avoidance; tax receipts; business cycle |
| :---: | :---: | :---: |
| Season 3 Episode 1 "No Más" | A plane crashed in the city of Albuquerque, NM. From damaged property to the loss of life on the ground, everybody is dealing with the negative externalities brought about by the crash. (04:15-05:26; 08:55-09:32) | Negative externalities |
| Season 3 Episode 1 "No Más" | In a small Mexican town, some of the locals do not walk but crawl towards the shrine of Santa Muerte. This behavior is a perfect example of how cultural norms create markets, in this case for knee and elbow guards. (00:23-01:15) | Invisible handshake; social norms as market determinants |
| Season 3 Episode 1 "No Más" | Group Leader: "But I was out of vodka. And this is in Portsmouth, Virginia; where instead of selling liquor in the supermarkets they have these ABC stores, which close at 5PM ..." (29:31-31:53) | Invisible foot; <br> consequences <br> regulation of unintended <br> government   |
| Season 3 Episode 1 "No Más" | Two short video clips on the cost/benefit analysis and the subjectivity of costs and benefits. The first pits a rural family against the criminal twins. The second clip shows how Walter weighs the costs and benefits of producing methamphetamine. $(22: 54-25: 07 ; 39: 42-42: 14)$ | Cost/benefit analysis; subjectivity of costs and benefits |
| Season 3 Episode 1 "No Más" | Even drug manufacturers love peanut butter and jelly. This video clip shows Walter preparing himself a peanut butter and jelly sandwich. (15:38-16:03) | Complements in consumption |
| Season 3 Episode 2 "Caballo Sin Nombre" | Please refer to the description provided within the section titled "Clips and the Associated Economics Concepts". (30:40-33:36) | Asymmetric information; product differentiation; product characteristics; profit-maximizing behavior; opportunity cost; economizing behavior |
| Season 3 Episode 2 "Caballo Sin Nombre" | Burgers and ketchup as complements in consumption. (16:25-16:50) | Complements in consumption |
| Season 3 Episode 3 "I.F.T." | Two short video clips on the cost/benefit analysis and the subjectivity of costs and benefits. The first depicts Skyler, who figures out that the benefit from turning Walter in is lower than the cost of doing so. Thus, she refrains from pursuing such action. The second depicts Walter who, once again, debates on the costs and benefits of cooking meth. (29:24-31:13; 39:00-41:17) | Cost/benefit analysis; subjectivity of costs and benefits |
| Season 3 Episode 4 "Green Light" | The crash of flight 515 represents a positive externality for Saul who, as a lawyer, might now initiate a class-action suit against the airline. (04:21-04:45) | Positive externalities |

$\left.\begin{array}{|l|l|l|}\hline \begin{array}{l}\text { Season 3 Episode 4 } \\ \text { "Green Light" }\end{array} & \begin{array}{l}\text { Jesse visits a gas station and, after filling up and asking for a pack of cigarettes, he } \\ \text { realizes that he has no cash on him. He proposes a trade; a little bag of "blue"" } \\ \text { methamphetamine against the gas and cigarettes. After hesitating initially, the cashier } \\ \text { accepts the trade. However, for the trade to take place, a mutual coincidence of wants } \\ \text { must emerge. It does in this case. Also, note that the cashier accepts the } \\ \text { methamphetamine under the false belief that it does not create addiction. (00:41- } \\ 03: 24)\end{array} & \begin{array}{l}\text { Medium of exchange; gains from } \\ \text { trade/barter; mutual coincidence of } \\ \text { wants; asymmetric information }\end{array} \\ \hline \begin{array}{l}\text { Season 3 Episode 4 } \\ \text { "Green Light" }\end{array} & \begin{array}{l}\text { Jesse fills up the RV's tank and asks for a pack of cigarettes. However, he does not } \\ \text { have the money to pay for these. He asks if he can come in a pay later but the cashier } \\ \text { tells him that the gas station belongs to her dad, who is very careful when it comes to } \\ \text { money. The gas station belongs to him and he has the incentive to care for it. Not the } \\ \text { same can be said about his daughter. According to her, Jesse could leave and come } \\ \text { back later. (00:41-1:30) }\end{array} & \begin{array}{l}\text { Property rights, incentive effects of } \\ \text { private proplem }\end{array} \\ \text { property; principal-agent }\end{array}\right\}$
$\left.\begin{array}{|l|l|l|l|}\hline \begin{array}{l}\text { Season 3 Episode 6 } \\ \text { "Sunset" }\end{array} & \begin{array}{l}\text { Mechanic: "Hold up. What's this about?" Walter: "The DEA, the Drug Enforcement } \\ \text { Administration. You have heard of them, right? They know all about this RV and } \\ \text { they are trying to find it right now." Mechanic: "I want this [RV] off my property, } \\ \text { now!" Walter: "No, no, we have got to destroy the evidence. We have got to rig this } \\ \text { thing to burn." Mechanic: "Not here! Get it out of here!" Walter: "Now listen to me! } \\ \text { I need your help! Okay? If I go down, we all go down. Do you understand?" } \\ \text { Mechanic: All right, just ... I know a way. I know a guy that will wipe this thing off } \\ \text { incentive } \\ \text { property rights }\end{array} & \begin{array}{l}\text { property } \\ \text { effects }\end{array} \\ \text { of }\end{array} \quad \begin{array}{l}\text { rights; } \\ \text { private }\end{array}\right]$

| Season 3 Episode 9 "Kafkaesque" | Through his decisions, Gus manages to create a monopoly in the methamphetamine market north of the Mexican border. He does so by drawing the attention of U.S. and Mexican governments onto the Cartel, with which he was sharing the market previously. With the Cartel not able to ship any methamphetamine to the U.S., Gus has the market to himself. (21:10-23:25) | Game theory; strategic behavior; market structure; monopoly |
| :---: | :---: | :---: |
| Season 3 Episode 10 "Fly" | Jesse knows that the demand for methamphetamine (an addictive good) is inelastic and, in this regard, consumers will not have much to object if the quality is lower than usual. Why? (15:13-16:27) | Elasticity of demand, quality |
| Season 3 Episode 11 "Abquiu" | One unintended consequence of policies that outlaw the production/distribution/consumption of drugs is the creation of money-laundering operations such as "Ice Station Zebra Associates". Walter uses this "company" to launder the money he earns from manufacturing methamphetamine. (13:15-15:02) | Unintended consequences; costs of illegal drugs; underground economy |
| Season 3 Episode 11 "Abquiu" | Who guards the guards? Walter supervises Jesse but their employer monitors both Walter and Jesse as they work in the lab. (05:51-06:52) | Monitoring; shirking; principalagent problem |
| Season 3 Episode 12 <br> "Half Measures" | Please refer to the description provided within the section titled "Clips and the Associated Economics Concepts". (09:06-14:52) | Cost of illegal drugs; unintended consequences of illegal drugs; human capital; poverty; restricted opportunity; social mobility; monopolistic competition; black markets; contract enforcement; dispute resolution; judicial system; role of institutions |
| Season 3 Episode 13 "Full Measures" | Walter and Skyler are in the market for a new house. Walter is attempting to maximize his utility by proposing to Skyler a larger house instead. In other words, Walter is trying to move onto a higher indifference curve. However, their limited budget represents a constraint to Walter's utility maximization problem. (01:3603:31) | Utility, utility maximization, indifference curve, budget constraint |
| Season 4 Episode 1 "Box Cutter" | The price system motivates Gus to purchase the equipment for the chemistry lab, hire the resources needed and take the risk to produce and distribute the methamphetamine. (00:00-04:30) | Invisible hand; elasticity of supply |
| Season 4 Episode 1 "Box Cutter" | Please refer to the description provided within the section titled "Clips and the Associated Economics Concepts". (01:41-04:30) | Product differentiation; monopolistic competition; alchianallen effect in prohibited drugs; potency effect; substitutes in consumption and production; cross-price elasticity of demand; marginal cost vs. marginal benefit |


| Season 4 Episode 2 "Thirty-Eight Snub" | "That, there, is why you you're going to pay me five times what you'd pay your neighborhood gun store." In addition to depicting the underground market for firearms, this clip is also useful to spark a discussion about gun control policies. (02:35-04:45) | Black market for firearms; prices; invisible hand; gun control policies; underground economy |
| :---: | :---: | :---: |
| Season 4 Episode 2 "Thirty-Eight Snub" | Jesse: "Yo, what's up with the pie man? It ain't cut!" Brandon: "Yeah, right. That's the gimmick." Jesse: "What gimmick?" Brandon: "This place, they don't cut their pizza and they pass the savings on to you" Jesse: "How much can it be to cut a damn pizza?" Brandon: "Gotta figure, you make, like, 10 million pizzas a year. Each pizza takes, like, 10 seconds to cut. In man - hours, that's ... I don't know! ... A lot?" (25:28-26:35) | Cost/benefit analysis; subjectivity of costs and benefits; scarcity; no such things as free lunch; tradeoffs |
| Season 4 Episode 3 "Open House" | Bogdan: "But this is not right. You cannot shut me down. You cannot do this." Agent: "I have checked your runoff gutters, and now out here, more contaminants. Ammonia, acetone, benzene, nitrobenzene." (28:20-30:50) | Market failures;negative <br> externalities; <br> government intervention; <br> gollionvisible <br> foot |
| Season 4 Episode 4 "Bullet Points" | Walter Jr.: "Cool! What makes it be all pink like that?" Hank: "Well, that's the manganese part. Okay? It oxidizes, you know, like rust." Walter: "Exactly, manganese can have an oxidation state between -3 and +7 , which takes it through a range of colors. Purple, green, blue. But its most stable state is +2 , which is usually pale pink. So ..." Hank: "Exactly! Whatever the hell he said." (15:34-16:18) | Positive Statement |
| Season 4 Episode 5 "Shotgun" | Walter: "You people have me down here trying to complete a two-man operation by myself. It is dangerous and counterproductive. It is unacceptable. Jesse operates the forklift, not me. That is one of the many, many things he does around the lab that keeps us on schedule." (29:00-30:14) | Specialization; division of labor; absolute advantage; productivity; economies of scale; short run; diminishing marginal productivity of inputs; over-utilization of fixed inputs |
| Season 4 Episode 6 "Cornered" | Walter: "I think it's time we got you your own car. What do you think?" Walter Jr.: "I think if you're going to buy me off ... buy me off!" (19:30-20:52) | Willingness to pay; product <br> characteristics;consumer <br> preferences; elasticity of demand |
| Season 4 Episode 6 "Cornered" | Jesse: "I'm getting those pricks out of that house." Mike: "Oh, your first attempt being such a wild success?" Jesse: "You may know this whole PI sit-in-the-car business but I know meth-heads." (32:14-35:20) | Job-specific skills; human capital; productivity |
| Season 4 Episode 7 "Problem Dog" | Walter: "Well that's what this is, problem solving. Skyler, this is a simple division of labor. I bring in the money. You launder it. This is what you wanted." (16:06-17:01) | Comparative advantage; division of labor; specialization |
| Season 4 Episode 11 "Crawl Space" | Jesse rushes Mike and Gus to a medical area they setup to treat them after the meeting with the cartel. The doctors rush out, start treating Gus, and ignore Mike who has been shot. Jesse brings Mike in and asks for help and the doctor points out that Gus is his priority as he pays his salary. (00:00-02:13) | Trade-offs; incentives |


| Season 4 Episode 11 "Crawl Space" | Huell and Patrick go to see Ted and make him pay off the IRS debt he owes. Ted signs the check and seems to be cooperating but decides to make a run for it. He takes off running, slips on his rug, and slams headfirst into his cabinet breaking his neck. (27:38-31:01) | Unintended consequences; incentives |
| :---: | :---: | :---: |
| Season 4 Episode 12 "End Times" | Gus and his people leave the meeting at the hospital with Jesse and head back to their car in the parking garage. As they approach the car, Gus stops and begins to look around at the rooftops around the garage. Walter is on a nearby rooftop and hides as Gus stands right across from him waiting and thinking. He decides to abandon his car, as he fears it may be a trap. (42:00-45:10) | Cost-Benefit analysis; strategic thinking |
| Season 5 Episode 2 "Madrigal" | DEA Chief: "I had him out to my house. Fourth of July. We cooked out in the backyard. My son shucked the corn. My daughter cut up potatoes. Fring brought seabass. Every time I grill it now, I make a little foil pouch, just like he showed me. The whole night we were laughing, telling stories, drinking wine. And he is somebody else completely." (18:10-19:04) | Asymmetric information |
| Season 5 Episode 3 "Hazard Pay" | Please refer to the description provided within the section titled "Clips and the Associated Economics Concepts". (38:41-44:06) | Total, fixed, variable, and transaction costs; profit; compensating differential; property rights; dispute resolution; judicial system; role of institutions; underground economy; money laundering; return to risk; black markets; gross domestic product |
| Season 5 Episode 4 "Fifty-One" | Walter: "Hey, Benny! What would you give me for it?" Benny: "[...] Well, I am not really looking for ..." Walter: "A hundred dollars? Fifty?" Benny: "Insurance company just shelled out $\$ 1,900$ for the parts alone." Walter: "Then it is a bargain. You give me fifty bucks, and she's all yours." Benny: "You sure about this?" Walter: "Sure as shooting." Benny: "I'll check the register." (00:00-02:35) | Willingness to pay; consumer surplus; law of demand; consumer tastes and preferences; shift in demand curve; subjective benefits |
| Season 5 Episode 5 "Dead Freight" | Mike and Walter discuss the methods of production and the various costs associated with the different ways of producing meth. (23:05-24:46) | Fixed costs; sunk costs; variable costs; cost of illegal drugs; unintended consequences; economic efficiency; |
| Season 5 Episode 6 "Buyout" | Mike and Jesse try to sell their share of the methylamine to a methamphetamine producer from Phoenix. However, the Phoenix producer wants it all, theirs and Walter's. This way he can control the entire market for methamphetamine. (25:1627:37) | Competition; supply and demand curves |


| Season 5 Episode 7 "Say My Name" | Walter discusses with and convinces the dealer from Phoenix that they should collaborate. This way, Walter's superior blue methamphetamine remains in production ant the methylamine, a key input, is used in the most efficient and profitable way. (00:30-04:48) | Economic efficiency; elasticity of demand; black markets; comparative advantage; monopolistic competition; product differentiation; product quality; elasticity of supply; intermediate inputs |
| :---: | :---: | :---: |
| Season 5 Episode 8 "Gliding Over All" | Lydia presents Walter with the opportunity of expanding into a new market (the Czech Republic). Lydia goes further and points out that entry should not be difficult given Walter's high-purity "blue" methamphetamine and the inferior alternatives available there. Also, it is worth noting that such overseas expansion would not have been possible without Lydia's expertise regarding global supply chains. (08:4711:22) | Elasticity of supply and demand; market entry; comparative advantage; opportunity cost; middleman; transaction cost; monopolistic competition; product differentiation; multinational enterprise; intra-firm trade; trade barriers |
| Season 5 Episode 8 "Gliding Over All" | This clip represents a wonderful account of all the moving parts of Walter's methamphetamine enterprise. Walter and Jesse cook, Lydia arranges and oversees the international shipments of methamphetamine, which are disguised as shipments of various chemicals between the subsidiaries of the multinational enterprise she works for, Todd coordinates the transportation operations, and Skyler is in charge of accounting and money laundering. Here, the division of labor and the comparativeadvantage based specialization is what makes their enterprise successful. (27:0827:44) | Comparative advantage; opportunity cost; division of labor; specialization |
| Season 5 Episode 8 "Gliding Over All" | Skyler takes Walter to a storage area she has rented and shows him the giant pile of money he has made from his meth business. She then asks him "How much is enough? How big does the pile have to be?" S5 E8 (31:54-34:39) | Scarcity; trade-offs; opportunity costs; leisure as normal good; income effect |
| Season 5 Episode 8 "Gliding Over All" | Walter stops by to see Jesse and they reminisce about why they kept using the old RV even after they had money. (38:15-39:59) | Cost-benefit analysis; opportunity cost; sunk cost |
| Season 5 Episode 10 "Buried" | Huell and Patrick are sent to get Walter's giant pile of money. Upon seeing it Huell and Patrick cannot resist the urge to lay on top of it. Huell suggests that they skip town with the money but Patrick points out that Walter had ten men killed, in prison, all within a two-minute window. (13:19-14:43) | Cost-benefit analysis |
| Season 5 Episode 11 "Confessions" | Jesse beats Saul and forces him to confess at gunpoint about helping Walter to poison the son of his (Jesse's) former girlfriend. (41:45-43:14) | Cost-benefit analysis |


| Season 5 Episode 13 "To'hajiilee" | Todd cooks a methamphetamine batch of only $76 \%$ purity and not the distinct blue color expected by European customers. Lydia comments that consumers expect the "blue", which is a signal of quality and purity, and will pay top dollar only for it. (00:00-02:39) | Consumer preferences; product differentiation; product quality; elasticity of demand |
| :---: | :---: | :---: |
| Season 5 Episode 14 "Ozymandias" | Walter drives to the desert to hide the cash generated by his methamphetamine enterprise but he runs out of gas. As he rolls one of the money-full barrels, he comes by a house and asks to buy the truck sitting in the driveway. Initially, the truck is not for sale but after he offers the man a large stack of money this changes. Next, we see Walter load the barrel in the back of the recently purchased vehicle. (21:5523:04) | Law of supply; incentives; opportunity cost; willingness to supply |
| Season 5 Episode 15 "Granite State" | Saul explains to Walter that his departure will cause tremendous harm to his family even if they were not involved in his methamphetamine-producing enterprise. (08:54-11:27) | Negative externality |
| Season 5 Episode 15 "Granite State" | Walter asks Ed if he would give the money to his family when he died. Ed asks Walter if he would believe him if he said yes. (39:41-40:36) | Moral hazard |
| Season 5 Episode 16 "Felina" | Walter is in his old house, which has been vandalized and is in awful shape. (20:3021:31) | Negative externality; property rights; incentive effects of private property |

Table A2: Concepts by Season, Episode, and Time

| Absolute advantage | Season 1 Episode 1/S1 E1 (27:34-30:07); S4 E5 (29:00-30:14) |
| :---: | :---: |
| Alchian-Allen effect | S4 E1 (01:41-04:30) |
| Asymmetric information | $\begin{aligned} & \text { S3 E2 (30:40-33:36); S3 E4 (00:41-3:24); S3 E6 (20:40-21:14); } \\ & \text { S3 E7 (23:54-25:20); S5 E2 (18:10-19:04) } \end{aligned}$ |
| Bargaining power | S3 E5 (42:08-43:31) |
| Barriers to entry | S1 E5 (00:00-01:20) |
| Becker model of criminal behavior | S2 E1 (04:24-06:03); S2 E11 (30:50-34:34) |
| Black markets | $\begin{aligned} & \text { S1 E1 (31:54-33:54); S3 E12 (09:06-14:52); S4 E2 (02:35- } \\ & 04: 45) ; \text { S5 E3 (38:41-44:06); S5 E7 (00:30-04:48) } \end{aligned}$ |
| Budget constraint | S3 E13 (01:36-03:31) |
| Business cycle | S2 E11 (30:50-34:34) |
| Capacity constraint | S1 E7 (07:00-08:04) |
| Comparative advantage | S1 E1 (27:34-30:07); S1 E6 (15:40-17:25); S4 E7 (16:06-17:01); S5 E7 (00:30-04:48); S5 E8 (08:47-11:22); S5 E8 (27:08-27:44) |
| Compensating differential | S5 E3 (38:41-44:06) |
| Competition | $\begin{aligned} & \text { S1 E1 (31:54-33:54); S3 E12 (09:06-14:52); S4 E1 (01:41- } \\ & 04: 30) ; \text { S5 E6 (25:16-27:37) } \end{aligned}$ |
| Complements in consumption | $\begin{aligned} & \text { S3 E1 (15:38-16:03); S3 E2 (16:25-16:50); S3 E4 (38:50-39:48); } \\ & \text { S3 E6 (12:10-12:48) } \end{aligned}$ |
| Consumer preferences | S4 E6 (19:30-20:52); S5 E4 (00:00-2:35); S5 E13 (00:00-02:39) |
| Consumer surplus | S2 E5 (12:00-14:50); S3 E5 (42:08-43:31); S5 E4 (00:00-2:35) |
| Contracts and contract enforcement | S3 E5 (42:08-43:31); S3 E12 (09:06-14:52) |
| Correlation is not causation | S1 E6 (31:43-34:12) |
| Cost of illegal drugs | $\begin{aligned} & \hline \text { S1E6 (31:43-34:12); S3 E11 (13:15-15:02); S3 E12 (09:06- } \\ & \text { 14:52); S5 E5 (23:05-24:46) } \end{aligned}$ |
| Cost-benefit analysis | S2 E1 (04:24-06:03); S2 E2 (21:05-21:57); S2 E11 (30:5034:34); S4 E12 (42:00-45:10); S5 E8 (38:15-39:59); S5 E10 (13:19-14:43); S5 E11 (41:45-43:14) |
| Cross-price elasticity of demand | S4 E1 (01:41-04:30) |
| Demand curve shift | S5 E4 (00:00-2:35); S5 E6 (25:16-27:37) |
| Diminishing marginal productivity | S4 E5 (29:00-30:14) |
| Dispute resolution | $\begin{aligned} & \text { S3 E5 (42:08-43:31); S3 E12 (09:06-14:52); S5 E3 (38:41- } \\ & \text { 44:06) } \end{aligned}$ |
| Division of labor | $\begin{aligned} & \text { S1 E1 (27:34-30:07); S1 E6 (15:40-17:25); S4 E5 (29:00-30:14); } \\ & \text { S4 E7 (16:06-17:01); S5 E8 (27:08-27:44) } \end{aligned}$ |
| Economies of scale | $\begin{aligned} & \text { S1 E6 (15:40-17:25); S3 E5 (23:10-25:30); S4 E5 (29:00-30:14); } \\ & \text { S5 E8 (27:08-27:44) } \end{aligned}$ |
| Economies of scope | S3 E5 (23:10-25:30) |
| Economizing behavior | S3 E2 (30:40-33:36) |
| Economic efficiency | S5 E5 (23:05-24:46); S5 E7 (00:30-04:48) |
| Elasticity of demand | S1 E1 (31:54-33:54); S2 E3 (08:48-12:23); S2 E5 (12:00-14:50) and (15:00-18:45); S2 E7 (40:13-40:48); S3 E6 (20:40-21:14); S3 E10 (15:13-16:27); S4 E1 (01:41-04:30); S4 E6 (19:30- $20: 52) ;$ S5 E7 (00:30-04:48); S5 E13 (00:00-2:39); S5 E8 $(08: 47-11: 11)$ |
| Elasticity of supply | $\begin{aligned} & \text { S1 E7 (07:00-08:04); S1 E7 (14:40-15:54); S2 E1 (23:24-25:06); } \\ & \text { S2 E10 (42:49-44:49); S3 E5 (23:10-25:30) and (42:08-43:31); } \\ & \text { S4 E1 (00:00-04:30); S5 E8 (08:47-11:11); S5 E7 }(00: 30-04: 48) \\ & \hline \end{aligned}$ |


| Fixed costs and inputs | $\begin{aligned} & \text { S1 E6 (15:40-17:25); S2 E10 (42:49-44:49); S3 E5 (00:00- } \\ & 00: 43) \text { and (23:10-25:30); S3 E9 (00:00-02:27); S5 E3 (38:41- } \\ & 44: 06) ; \text { S5 E5 (23:05-24:46) } \end{aligned}$ |
| :---: | :---: |
| Gains from trade/barter | S3 E4 (00:41-3:24); S1 E1 (27:34-30:07) |
| Game theory | S1 E1 (27:34-30:07); S3 E9 (21:10-23:35) |
| Government intervention/regulation | S3 E1 (29:31-31:53); S4 E3 (28:20-30:50) |
| Gross domestic product | S5 E3 (38:41-44:06) |
| Gun control | S4 E2 (02:35-04:45) |
| Health care concepts (e.g., HMO, PPO) | S1 E4 (17:08-18:53) |
| Housing market | S2 E10 (38:56-40:36) |
| Human capital | S1 E5 (00:00-01:20); S3 E12 (09:06-14:52); S4 E6 (32:14- 35:20); |
| Incentives | S1 E1 (27:34-30:07); S1 E7 (07:00-08:04); S2 E3 (08:48-12:23); S2 E4 (09:22-12:10); S2 E5 (15:00-18:45); S3 E4 (00:41-1:30); S3 E6 (29:27-30:07); S3 E6 (35:30-37:02); S4 E11 (00:0002:13) and (27:38-31:01); S5 E14 (21:55-23:04); S5 E16 (20:3021:31) |
| Income effect | S5 E8 (31:54-34:39) |
| Income tax | S2 E11 (30:50-34:34) |
| Indifference curve | S3 E13 (01:36-03:31) |
| Inflation | S2 E1 (04:24-06:03); S2 E10 (38:56-40:36) |
| Intermediate inputs | S2 E10 (42:49-44:49); S5 E7 (00:30-04:48) |
| Intra-firm trade | S5 E8 (08:47-11:22) |
| Invisible foot | S4 E3 (28:20-30:50); S3 E1 (29:31-31:53) |
| Invisible hand | S4 E1 (00:00-04:30); S4 E2 (02:35-04:45) |
| Invisible handshake | S3 E1 (00:23-01:15) |
| Job search | S1 E5 (00:00-01:20) |
| Judicial system | S3 E12 (09:06-14:52); S5 E3 (38:41-44:06) |
| Law of demand | S5 E4 (00:00-2:35) |
| Law of supply | S5 E14 (21:55-23:04) |
| Marginal analysis | S2 E1 (04:24-06:03); S4 E1 (01:41- 04:30) |
| Market entry | S5 E7 (00:30-04:48); S5 E8 (08:47-11:22) |
| Market failure | S4 E3 (28:20-30:50) |
| Market power | S1 E1 (31:54-33:54); S2 E7 (40:13-40:48); S3 E5 (42:08-43:31) |
| Market structure | S3 E9 (21:10-23:25) |
| Medium of exchange | S3 E4 (00:41-3:24) |
| Middleman | S1 E6 (15:40-17:25); S5 E8 (08:47-11:22) |
| Money laundering | S5 E3 (38:41-44:06) |
| Monitoring | S3 E9 (00:00-2:27); S3 E8 (27:40-29:44); S3 E11 (05:51-06:52) |
| Monopolistic competition | S1 E1 (31:54-33:54); S3 E12 (09:06-14:52); S4 E1 (01:4104:30); <br> S5 E7 (00:30-04:48); S5 E8 (08:47-11:22) |
| Monopoly | S2 E7 (40:13-40:48); S3 E9 (21:10-23:25) |
| Monopsony | S3 E5 (42:08-43:31) |
| Moral hazard | S5 E15 (39:41-40:36) |

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| Mutual coincidence of wants | S3 E4 (00:41-3:24) |
| :---: | :---: |
| Multinational enterprise | S5 E8 (08:47-11:22) |
| Negative externality | S1 E6 (31:43-34:12); S4 E3 (28:20-30:50); S5 E15 (08:5411:27); S5 E16 (20:30-21:31) |
| Normal good | S5 E8 (31:54-34:39) |
| Opportunity cost | $\begin{aligned} & \text { S1 E6 (15:40-17:25); S1 E7 (11:48-13:07); S2 E2 (21:05-21:57); } \\ & \text { S3 E2 (30:40-33:36); S5 E8 (08:47-11:22), (27:08-27:44) and } \\ & \text { (38:15-39:59); S5 E14 (21:55-23:04) } \end{aligned}$ |
| Optimal output | S1 E7 (07:00-08:04); S3 E5 (23:10-25:30) |
| Pollution | S4 E3 (28:20-30:50) |
| Positive externalities | S3 E4 (04:21-04:45) |
| Potency effect | S4 E1 (01:41-04:30) |
| Poverty | S3 E12 (09:06-14:52) |
| Principal-agent contract | S3 E4 (00:41-03:24); S3 E8 (27:40-29:44); S3 E9 (00:00-02:27); S3 E11 (05:51-06:52) |
| Private property | S2 E3 (08:48-12:23); S2 E4 (09:22-12:10); S2 E5 (15:00-18:45); S3 E4 (00:41-03:24); S3 E6 (29:27-30:07); S3 E6 (35:30-37:02); S5 E16 (20:30-21:31) |
| Producer surplus | S2 E5 (12:00-14:50); S3 E5 (42:08-43:31) |
| Product characteristics | S4 E6 (19:30-20:52); S3 E2 (30:40-33:36) |
| Product differentiation | S1 E1 (31:54-33:54); S3 E2 (30:40-33:36); S4 E1 (01:41-04:30); S5 E7 (00:30-04:48); S5 E8 (08:47-11:22); S5 E13 (00:0002:39) |
| Production costs | S3 E9 (00:00-02:27) and (03:03-05:05) |
| Productivity | S4 E5 (29:00-30:14); S4 E6 (32:14-35:20) |
| Profit | S5 E3 (38:41-44:06) |
| Profit-maximizing behavior | S3 E2 (30:40-33:36) |
| Profit-motive | S1 E7 (07:00-08:04) |
| Production possibility frontier shift | S3 E12 (09:06-14:52) |
| Quality | $\begin{aligned} & \text { S3 E10 (15:13-16:27); S5 E7 (00:30-04:48) ; S5 E13 (00:00- } \\ & 02: 39) \end{aligned}$ |
| Reservation income/wage | S2 E1 (04:24-06:03) |
| Restricted opportunity | S3 E12 (09:06-14:52) |
| Return to risk | S1 E6 (15:40-17:25); S3 E9 (03:03-05:05); S5 E3 (38:41-44:06) |
| Role of institutions | S3 E5 (42:08-43:31); S3 E12 (09:06-14:52) |
| Scarcity | S4 E2 (25:28-26:35); S5 E8 (31:54-34:39) |
| Shift in demand | S5 E4 (00:00-2:35) |
| Shirking | S3 E8 (27:40-29:44); S3 E9 (00:00-2:27); S3 E11 (05:51-06:52) |
| Social mobility | S3 E12 (09:06-14:52) |
| Specialization | S1 E1 (27:34-30:07); S1 E6 15:40-17:25); S4 E5 (29:00-30:14); S4 E7 (16:06-17:01); S5 E8 (27:08-27:44) |
| Specialized inputs | S2 E10 (42:49-44:49) |
| Strategic behavior | S3 E9 (21:10-23:25); S4 E12 (42:00-45:10) |
| Subjectivity of costs and benefits | $\begin{aligned} & \text { S2 E2 (21:05-21:57); S3 E1 (22:54-25:07) and (39:42-42:14); } \\ & \text { S3 E3 (29:24-31:13) and (39:00-41:17); S3 E9 (03:03-05:05); } \\ & \text { S4 E2 (25:28-26:35); S5 E4 (00:00-02:35) } \end{aligned}$ |


| Substitute inputs | S1 E7 (14:40-15:54); S2 E1 (23:24-25:06) |
| :--- | :--- |
| Substitutes in consumption | S4 E1 (01:41-04:30) |
| Substitutes in production | S4 E1 (01:41-04:30) |
| Sunk costs | S5 E5 (23:05-24:46); S5 E8 (38:15-39:59) |
| Supply | S5 E6 (25:16-27:37) |
| Supply chains | S1 E6 (15:40-17:25) |
| Tax fraud | S2 E11 (30:50-34:34) |
| Total costs | S1 E6 (15:40-17:25); S5 E3 (38:41-44:06) |
| Trade-offs | S4 E2 (25:28-26:35); S4 E11 (00:00-02:13) ; S5 E8 (31:54- |
|  | 34:39) |
| Trade barriers | S5 E8 (08:47-11:22) |
| Transaction costs | S3 E5 (42:08-43:31); S3 E7 (23:54-25:20); S3 E9 (03:03-05:05); |
|  | S5 E3 (38:41-44:06); S5 E8 (08:47-11:22) |
| Ultimatum game | S1 E1 (27:34-30:07) |
| Underground economy | S1 E7 (07:00-08:04); S3 E9 (00:00-02:27) and (03:03-05:05); |
|  | S3 E11 (13:15-15:02); S4 E2 (02:35-04:45); S5 E3 (38:41- |
|  | 44:06) |
| Unemployment | S1 E5 (00:00-01:20); S2 E10 (38:56-40:36) |
| Unintended consequences | S3 E1 (29:31-31:53); S3 E11 (13:15-15:02); S3 E12 (09:06- |
|  | 14:52); S4 E11 (27:38-31:01); S5 E5 (23:05-24:46) |
| Unlimited wants and needs | S5 E8 (31:54-34:39) |
| Utility | S1 E1 (31:54-33:54); S3 E13 (01:36-03:31) |
| Utility maximization | S1 E1 (31:54-33:54); S3 E13 (01:36-03:31) |
| Variable costs and inputs | S2 E10 (42:49-44:49) |
| Willingness to pay | S2 E3 (08:48-12:23); S2 E5 (12:00-14:50); S3 E5 (42:08-43:31); |
| Willingness to supply | S2 E3 (19:30-20:52); S5 E7 (00:30-04:48) |

## APPENDIX B

B.1. Suggested Questions for Season 3, Episode 5 "Mas" (Time 42:08-43:10); Concepts: Monopsony; Market Power; Bargaining Power; Transaction Costs; Willingness to Supply; Producer Surplus; Willingness to Pay; Consumer Surplus; Elasticity of Supply; Contracts; Contract Enforcement; Role of Institutions; Dispute Resolution

Bloom's: Analyze/AACSB: Analytic
In this clip, Walter and Saul negotiate over a money-laundering fee. Suppose Walter and Saul have a prestanding agreement, according to which the money-laundering fee is $15 \%$. Describe the outcome of their bargain by using the concepts of consumer and producer surplus. In formulating your answer, discuss who emerges as the winner of this negotiation and why? Who loses welfare, how much welfare is lost, and why?

POSSIBLE RESPONSE (see Table B1 for a suggested grading rubric): As a result, of their negotiation, the money-laundering fee declines from $15 \%$ to $5 \%$. On one hand, this outcome is great for Walter. His consumer surplus increases as the fee declines. On the other hand, the result of their negotiation is less favorable for Saul. As the fee declines, his producer surplus decreases as well. Specifically, he loses $(15 \%-5 \%) * \$ 3,000,000$ or $\$ 300,000$. Saul, therefore, loses because of the negotiation; most likely because his supply for moneylaundering services is perfectly inelastic over the observed price range (i.e., $5 \%$ to $15 \%$ ). Nevertheless, it is worth noting that even with a money-laundering fee of $5 \%$, Saul may still receive a positive producer surplus.

Table B1: Suggested Grading Rubric

| Grading Criteria | Ratings |  |  |
| :---: | :---: | :---: | :---: |
| $\begin{aligned} & \text { Clarity of the } \\ & \text { response } \end{aligned}$ | The response is thorough, accurate, well-articulated (10 points) | The response is accurate, but not thorough nor well-articulated to demonstrate adequate understanding points) | A response is included but is not accurate, thorough and wellarticulated demonstrate adequate understanding (5 points) |
| $\begin{aligned} & \hline \text { Referencing the } \\ & \text { concept of } \\ & \text { consumer surplus } \end{aligned}$ | The answer correctly references the concept of consumer surplus (10 points) | The answer incorrectly references the concept of consumer surplus (5 points) | The answer does not reference the concept of consumer surplus (0 points) |
| $\begin{array}{lr} \hline \text { Referencing } & \text { the } \\ \text { change in } \\ \text { consumer surplus } \end{array}$ | The change in consumer surplus was correctly identified and supported by an adequate explanation (10 points) | The change in consumer surplus was correctly identified but was not supported by an adequate explanation (5 points) | The change in consumer surplus was incorrectly identified (0 points) |
| Referencing theconcept <br> producer surplus | The answer correctly references the concept of producer surplus (10 points) | The answer incorrectly references the concept of producer surplus (5 points) | The answer does not reference the concept of producer surplus (0 points) |
| Referencing the change in producer surplus | The change in producer surplus was correctly identified and supported by an adequate explanation (10 points) | The change in producer surplus was correctly identified but was not supported by an adequate explanation (5 points) | The change in producer surplus was incorrectly identified (0 points) |
| Concluding remarks | The response benefits from a thorough, accurate, and well-articulated concluding sentence/phrase points) | The response benefits from an accurate concluding sentence/phrase but not thorough and wellarticulated (5 points) | The answer does not include a concluding sentence/phrase points) |

Bloom's: Analyze/AACSB: Analytic
Even with the much-reduced money-laundering fee of $5 \%$, Saul's producer surplus is positive.
$\begin{array}{ll}\text { A. } & \text { True } \\ \text { B. } & \text { False }\end{array}$
B. False

Bloom's: Remember/AACSB: Reflective Thinking
Based on how the negotiation proceeds, Saul's supply for money-laundering services, over the $5 \%$ to $15 \%$ price range, is $\qquad$ -.
A. elastic
B. inelastic
C. unit-elastic
D. perfectly inelastic
E. perfectly elastic

## Bloom's: Understand/AACSB: Reflective Thinking

Based on how the negotiation proceeds, the market, in which Saul and Walter interact, is best described as
A. a monopoly
B. perfectly competitive
C. a monopsony
D. an oligopoly

Bloom's: Analyze/AACSB: Analytic
As Saul and Walter negotiate a money-laundering fee, which of the following represents an outcome of their negotiation?
A. Consumer surplus increases
B. Producer surplus increases
C. Money-laundering fee decreases
D. All of the above
E. A and C, only

Bloom's: Apply/AACSB: Analytic
Saul and Walter negotiate a fee for money-laundering services. Because of their negotiation, Saul's producer surplus declines by $\qquad$ _.
A. $\$ 300,000$
B. $\$ 150,000$
C. $\$ 450,000$
D. $\$ 510,000$
B.2. Suggested Questions for Season 5, Episode 3 "Hazard Pay" (38:41-42:34); Concepts: Total, Fixed, Variable, and Transaction Costs; Profit; Compensating Differential; Property Rights; Dispute Resolution; Judicial System; Role of Institutions; Underground Economy; Money Laundering; Black Markets: Return to Risk; Gross Domestic Product

Bloom's: Analyze/AACSB: Analytic
In this clip, Mike, Walter, and Jesse split the proceeds from their new methamphetamine-producing enterprise. Describe the division of their revenue in terms of costs and profits. When formulating your answer (i) explain the difference between variable costs and fixed costs; (ii) identify at least two examples of each; (iii) calculate the total profits for the three partners; (iv) identify the profit type by explaining the difference between economic profits and accounting profits; and (v) suggest a situation in which the accounting profits are higher than the economic profits.

POSSIBLE RESPONSE (see Table B2 for a suggested grading rubric): The clip shows a process that appears frequently on the calendar of every business: separating the costs from total revenue to retrieve the profit. It is also important to distinguish between variable and fixed costs. Unlike fixed costs, variable costs fluctuate with the size of output; in this case, the amount of methamphetamine produced. For example, expenditures with the "mules" (transportation services) and methylamine (a key input) are variable. The larger the output, the larger the total revenue and, hence, the cost with the "mules", which represents $20 \%$ of the revenue. Also, the larger the output, the larger the amount of methylamine needed and, hence, the higher the cost with this input. Fixed costs do not vary with the amount of output (at least in the short run). The expenses with Jesse's loan, Ira and his people, and the lawyer (i.e., Saul Goodman), are examples of fixed costs. The total profit is found by subtracting the total (variable and fixed) costs from the total revenue; an accounting profit of $\$ 411,000$ (or $\$ 137,000$ for each Mike, Walter, and Jesse) is thus recovered. Since no information about the opportunity cost of being in the methamphetamine business is presented, one cannot tell much about the economic profit. As long as the opportunity cost of manufacturing is positive, the economic profit is less than $\$ 411,000$. Accounting profit is always larger than the economic profit because it does not take into account the implicit opportunity cost of production/being in business.

Bloom's: Analyze/AACSB: Analytic
The cost with the mules/transportation is fixed and represents twenty percent of total revenue.
A. True
B. False

Table B2: Suggested Grading Rubric

| Grading Criteria | Ratings |  |  |
| :---: | :---: | :---: | :---: |
| Clarity of the response | The response is thorough, accurate, and well-articulated points) | The response is accurate but not thorough nor wellarticulated to demonstrate adequate understanding (7.5 points) | A response is included but is not accurate, thorough and wellarticulated demonstrate adequate understanding (5 points) |
| Discussing the difference between fixed and variable costs | The answer correctly distinguishes between fixed and variable costs (10 points) | The answer incorrectly distinguishes between fixed and variable costs (5 points) | The answer does not reference fixed and variable costs (0 points) |
| Identifying the fixed costs | The answer provides two correct examples of fixed costs (10 points) | The answer provides one example of a fixed cost (5 points) | The answer does not provide examples of fixed costs (0 points) |
| Identifying the variable costs | The answer provides two correct examples of variable costs (10 points) | The answer provides one example of a variable cost (5 points) | The answer does not provide examples of variable costs (0 points) |
| Calculating the total profit for the illegal enterprise | Correctly calculating the total points $)$ | Incorrectly calculating the total profit but correctly calculating the profit/person (5 points) | Incorrectly calculating the total profit (0 points) |
| Distinguishing between accounting and economic profits | The response <br> distinguishes between <br> accounting and <br> economic profits <br> thoroughly and <br> accurately and is well  <br> articulated (10 points)  | The response accurately distinguishes between economic and accounting profits, but is not thorough nor well-articulated to demonstrate adequate understanding ( 7.5 points) | The response attempts to distinguish between economic and accounting profits, but is not accurate, thorough, and well-articulated to demonstrate adequate understanding (5 points) |
| Discussing the link between accounting and economic profits | The response correctly identifies the relationship between accounting and economic profits (10 points) |  | $\begin{array}{lrr} \hline \text { The response } & \text { incorrectly } \\ \text { identifies } & \text { the } \\ \text { relationship } & \text { between } \\ \text { economic } & \text { and } \\ \begin{array}{lr} \text { accounting } & \text { profits } \end{array} \text { (0 } \\ \hline \text { points) } & & \\ \hline \end{array}$ |

Bloom's: Remember/AACSB: Reflective Thinking
Which of the individuals/categories/items shown below represent a variable cost?
A. Mules/transportation.
B. Ira and his guys
C. Lawyer
D. Methylamine
E. A and D, only

Bloom's: Analyze/AACSB: Analytic
Based on the conversation between Mike and Walter, what must be factored into the calculation of the opportunity cost of killing Gus Fring?
A. Twenty percent of the revenue generated by each cook session
B. The distribution network, which Gus Fring created
C. The sixteen trucks, which are currently in government impound
D. All of the above
E. A and B, only

Bloom's: Analyze/AACSB: Analytic
What is the total profit generated through the manufacturing and sale of methamphetamine?
A. $\$ 367,000$
B. $\$ 137,000$
C. $\$ 411,000$
D. $\$ 1,101,000$

Bloom's: Apply/AACSB: Analytic
Using the total revenue emphasized by Walter, the cost with the mules/transportation is $\qquad$ .
A. $\$ 300,000$
B. $\$ 275,000$
C. $\$ 278,560$
D. $\$ 367,000$

# Information Source Selection in Investment Decisions: The Role of Risk Attitudes, Gender, and Education 

Hossein Nouri and Abdus Shahid ${ }^{1}$


#### Abstract

This study examines the information sources that beginning undergraduate business students employ to make investment decisions. The results show that gender and type of business major affect the use of information sources for investment decisions. Male students use more personal/family information sources, whereas female students use more outside broker and magazine information sources for investment decision-making. We also find that finance majors use personal/family information sources while accounting students use outside-broker/magazine-information sources. In addition, this study shows an interaction between risk attitudes and gender affecting the use of information sources for investment decision-making.


## Introduction

This study investigates how beginning business-educated investors who are financially literate make investment decisions. In particular, we examine the information sources these individuals use in investment decisions. For this study, we used senior business majors (e.g., accounting, finance, international business, management, and marketing) as surrogates for financially literate investors. The information sources that these novice business-educated investors use enhance our understanding of information utilization.

The study considers two sources of information used for investment decisions: students' own knowledge and, in contrast, recommendations from professional journals and brokers. Undergraduate finance programs offer investment courses, and these courses cover fundamentals of sound investment decisions such as risk and return management, asset allocation, portfolio management, and financial statement analysis. For example, universities such as California-Berkeley, Illinois-Urbana-Champaign, and Indiana-Bloomington typically have courses entitled "Investments," "Investment and Portfolio Management," "Intermediate Investments," etc. within undergraduate finance programs. The results of the study provide insight for finance professors as to whether student investors use investment selection procedures, particularly information sources, learned in finance courses.

This study also compares for gender in student investment decisions. While numerous empirical studies have examined differences between male and female investors in information-gathering, confidence level, and attitude toward risk (Barber and Odean 2001; Estes and Hosseini 1988; Lewellen et al. 1997; Stinerock et al. 1991; and Jianakopolos and Bernasek 1998), no known study has examined college performance as measured by grade point average (GPA), choice of business major, and the interaction between risk attitudes and gender on information utilization for investment decisions. In addition, a primary difference between this study and previous studies is that our student investors are neither expert nor naïve. Our subjects are business students who have some familiarity with corporate annual reports and the functioning of financial markets. These students have finished both accounting and finance courses as proxies for beginning investors who can read and understand financial statements and markets. However, our subjects are not equally financially literate; for example, finance and accounting majors typically take more finance courses compared to

[^5]management and marketing students. A notable contribution of our study is that the information sources used in investment decisions help us understand how these business-educated young investors use information.

The results show that males and females chose different information sources for investment decisions. While the findings suggest that risk attitudes have no effect on the use of information sources for investment decisions, it indicates that there is an interaction between risk attitudes and gender affecting the use of information sources for investment decisions. Furthermore, the results support the proposition that participants with different majors chose different information sources for investment decisions. Finally, we found that college performance as measured by GPA had no effect on the usage of information sources for investment decisions.

The remainder of this paper consists of four sections, beginning with discussion of previous literature and hypotheses development. The second section reports the methodology; the third and fourth sections present, respectively, the results and a summary with conclusion.

## Literature Review and Hypotheses Development

## Gender, Confidence, and Information Gathering

Behavioral finance literature demonstrates that men are more overconfident than women in investing. To test the association between investment confidence and gender, Barber and Odean (2001) examine the trading behavior of about 78,000 households from February 1991 to January 1997. Their study predicts that men will trade more actively than women since men are more confident. The results show that men turn their portfolios over $77 \%$ annually compared to women, who turn their portfolios over $53 \%$. This shows that men trade $45 \%$ more than women. A related finding reveals that, since men trade more aggressively, their portfolio returns are lower than women's. The lower returns of men's portfolios stem from excessive trading rather than selection of poor-performing stocks. The results also show that single men trade more aggressively than single women, supporting the prediction that men are more overconfident than women.

Survey results also demonstrate that men are more confident in their investing abilities than women. For example, according to a Harris survey (Bach 2000), young women perceive investing as "scary"-a sharp contrast with men. Similarly, $73 \%$ of men and $52 \%$ of women believe that investing is fun; meanwhile, $82 \%$ of men and $52 \%$ of women show confidence in their investment activities. Estes and Hosseini (1988) report that women are significantly less confident than men in their ability to make investment decisions after controlling for other factors such as age, business experience, the number of courses in finance and accounting, and number of years of college. Estes and Hosseini (1988, p. 586) also find that "Women's confidence appears to be lower than men's without regard to the quality of the decision and is in fact lower even when the decision is the same as that made by statistically equivalent males."

Lewellen et al. (1977) analyze brokerage records across seven years as well as questionnaire responses of 972 individual customers of a large national retail broker house. The questionnaire asked for information on demographic characteristics, market attitudes, decision processes, portfolio strategies, and asset holdings. The survey results show distinct differences between male and female respondents in information gathering and decisions, especially that women depend on brokers' advice more than men, who mostly rely on their own judgment and analysis. Lewellen et al. (1977, p. 311) report that "In general, male investors claim to do considerably more of their own security analysis and allege spending more time and money on that activity than do women. The latter tend to rely heavily on their broker's (account executive's) advice for portfolio decisions." Stinerock et al. (1991) show that, compared to male investors, women more frequently use financial advisers and display higher financial anxiety.

Since the literature suggests that women are less confident and use more of outside sources (magazines, brokers) than men in investment decisions, our first hypothesis is:

H1: Gender of beginning business-educated investors has no effect on the type of information source they use for investment decisions.

## Risk Attitudes and Information Sources

Several studies have examined the relationship between risk attitudes and information sources. Hazen and Sounderpandian (1999) argue that the relative values of competing information acquisitions depend on
the nature of the acquisition. They show that an expected utility maximizer is willing to take more risk when there is a greater probability price. Hugstad et al. (1987) examine how California female heads-of-household made decisions with regard to product choice. Their study finds that perceived risk is related to use of different information sources in choosing products. Schwalenstocker (2006, p. 113), after reviewing the literature on perceived risk and product choices, concludes that perceived risk is positively related to the degree of information search. She further notes that "there is some evidence that the degree and type of perceived risk influence the sources consulted."

In a different context, Pennings et al. (2004) note that agricultural producers highly value market advisory services (MAS) as a source of price risk management information and advice. Pennings et al. (2004, p. 308) report that "Risk attitude does not affect the impact of MAS recommendations on producers' decisions," suggesting that risk attitudes may have no effect on information sources. On the other hand, Rejesus et al. (2008) find that younger risk-loving farmers with college education tend to prefer information from MAS and other professional services.

Cho and Lee (2006) demonstrate the negative effect of risk propensity on information gathering, including the amount of information search (Taylor and Dunnette 1974; Yeoh 2000) and the likelihood of seeking advice from experts and professionals (Money and Crotts 2003; Welsch and Young 1982). Gould (1974) shows the lack of a relationship between information value and the degree of absolute or relative risk aversion. The relationship between risk aversion and value of information has been the subject of previous studies (e.g., Featherman 2003; Freixas and Kihlstrom 1984; Willinger 1989). These studies suggest that higher risk aversion induce a higher valuation of information since "gathering information before acting is a means of reducing the risks inherent in a decision" (Delquié 2008, p. 129). Shun-Yao (2012) also concludes that individuals with more risk aversion tend to seek more information. On the other hand, Eeckhoudt and Godfroid (2000) contend that as risk aversion increases, the value of information may decrease.

Based on prior literature, more risk-averse, naïve, business-educated investors should be more attracted to professional journals and brokers and thus follow their recommendations more closely to reduce investment risk. On the other hand, risk-loving, naïve, business-educated investors should be more willing to use their own knowledge to make investment decisions. This leads to the second null hypothesis of the study:

## H2: Risk attitudes of beginning investors have no effect on the type of information sources used for investment decisions.

## Risk Attitudes, Gender, and Information Source

Since prior research findings disagree about the relationship between risk attitudes and use of information sources, the next section of the present study examines an interaction between risk attitudes and gender affecting use of information sources. As Schwalenstocker (2006, p. 113) notes, "the relationship between perceived risk and searching may be complex. For example, perceived risk may interact with other variables to influence the search...."

Differences between male and female investors in attitude toward risk are well-documented in the literature. Prior studies concluded that women are more risk-averse than men when making investment decisions. Jianakopolos and Bernasek (1998) report that single women are more risk-averse than single men, and single women have a smaller proportion of risky assets than do single men and married couples. They also find that as household wealth increases, relative risk aversion decreases. According to Jianakopolos and Bernasek (1998, p. 629) "However, we find that relative risk aversion does not decrease as much for single women as for single men, indicating that single women are relatively more risk-averse."

In an experimental study consisting of 136 male and 120 female undergraduate students enrolled in social science and business courses, Eckel and Grossman (2008) report that male students are significantly less riskaverse than female in all three treatments: abstract/loss, investment, and abstract/no loss.

On the other hand, Schubert et al. (1999) report that risk attitudes of male and female student investors depend on contextual settings such as in investment decisions and gambling (gain-gambling and lossgambling). Their experimental results show females are not more risk-averse than male subjects in investment decisions; however females show more risk seeking behavior than males in loss gambling.

As discussed previously, risk-averse, naïve, business-educated investors should be more attracted to professional journals and brokers, thus following their recommendations more closely to reduce investment risk. On the other hand, risk-loving naïve business-educated investors should be more willing to use their own knowledge to make investment decisions. Since males are more risk-takers and females are more risk-
averse, we expect males to choose more from personal/family information sources while females choose broker/magazine information sources for investment decisions. The related null hypothesis is:

> H3: There is no interaction between gender and risk attitudes of business-educated student investors affecting their use of information source for investment decisions.

## Education and Information Sources

In this study, we examine two factors related to education: academic performance as measured by GPA and type of business major. While prior studies show that education affects the degree of search (Claxton et al. 1974; Kiel and Layton 1981; Newman 1977), the number of sources (Freiden and Goldsmith 1989; Lin and Lee 2004; Souter and McNeil 1995; Swartz and Stephens 1984), and various information sources (Feldman et al. 2000; Schwalenstocker 2006), no known research has examined whether academic performance and/or type of business education degree has any effect on the use of various information sources. As for academic performance, Richardson et al. (2012, p. 359) show a large positive association between students' academic grade and motivational factors such as "efficacy expectations," meaning "perceptions of personal capabilities to perform." Therefore, we posit that students having higher academic grades will have higher perceptions about their capabilities compared to students with lower academic grades; the former set of students will also perform their own analyses before making investment decisions. These considerations lead to the next null hypothesis:

## H4: GPA of beginning educated investors has no effect on the type of information source they use for investment decisions.

Anecdotal evidence suggests that students with more accounting and finance courses may use their own information sources more often than students who take only a few (one or two) accounting and finance courses. According to Most (1980), investment decision-makers rate corporate annual reports as the most important information source, with newspaper and magazines second. Most (1980) also reveals that user education and training in accounting and business administration increases the use of financial statements. Westbrook and Fornell (1979) demonstrate that education is positively related to the use of books, magazines, etc., while Estes and Hosseini (1988) suggest that confidence increases with a rising stock market, a positive investment attitude, and academic study in the fields of accounting and finance. Thus, this study posits that academic study in the fields of accounting and finance boosts individuals' confidence in using their own sources of information for investment decisions. Other business majors with fewer accounting and finance courses are more likely to use brokers and/or other sources of information for such decisions. Therefore, the study's last null hypothesis is:

H5: There is no difference among business student investors with different majors in their use of information source for investment decisions.

## Methodology

Undergraduate senior business students took part in this study. Students were enrolled in the required Strategic Management course offered in the final semester prior to their graduation. Students had already taken all required business courses. One hundred twenty-nine students participated in the study in Spring 2008 when the subprime mortgage crisis had not yet affected the market. Not all students responded to all questions so the number of subjects is different for each hypothesis.

We asked students to complete a questionnaire distributed during class. They were told the purpose of the study was to examine information sources and risk attitudes across different undergraduate business majors as well as to investigate how individuals who are familiar with and can read and understand financial statements make investment decisions. Students were told that participation was not mandatory. The study was approved by the Institutional Research Board at the institution where it was conducted.

The questionnaire asked students what would be the most likely way they would make their investment decisions if they inherited $\$ 50,000$ and wished to invest it. Students were asked to choose one of the following options (see the appendix for the questionnaire):
a) Read and analyze financial statements yourself
b) Use business magazine/journal advice
c) Use brokers
d) Use family advice
e) Track stocks yourself
f) Other (Explain):

In addition, the questionnaire asked for background information about age, marital status, gender, GPA, risk type (i.e., risk-averse, risk-neutral, risk-taker), and major.

The average age of the students was 22 years ( 126 students were between 20 and 24 and the other three were 27,29 , and 59 years old). Out of 129 students, only one was married. Out of 115 students who responded to the gender question, 48 were female and 67 were male. There were 16 male and 16 female accounting majors, and 26 male and 11 female finance majors. Other majors had 21 ( $46 \%$ ) female and 25 (54\%) male students.

## Results

Crosstab and logit analyses were used to test the study's hypotheses. Hypotheses 1, 2, 3, and 5 were analyzed using crosstab analysis since both dependent and independent variables were categorical data. Hypothesis 4 was analyzed using logit since the dependent variable was categorical and the independent variable was continuous. In addition, we used two information sources for this study: use of outside sources (items b and c) and use of personal or family knowledge (items a, d, and e). Item (f) was added to either of these two based on individual participants' explanations; otherwise, participants were deleted from the study because they were not related to either of the two outside sources (thus three students were deleted).

## Test of Hypothesis 1

Hypothesis 1 posits that the gender of beginning business-educated investors has no effect on the type of information source they use for investment decisions. Out of 129 participants, 48 females and 67 males responded to the gender question, for a total of 115 . Table 1 presents the $2 \times 2$ contingency table for information source and gender.

Table 1: Cross Tabulation of Gender by Information Source

|  | Personal/Family <br> Knowledge | Outside Sources <br> Magazine/Broker | Total |
| :---: | :---: | :---: | :---: |
| Male | $\mathrm{n}=37$ | $\mathrm{n}=30$ | $\mathrm{n}=67$ |
|  | \% within $\mathrm{IS}=69.8 \%$ | \% within $\mathrm{IS}=48.4 \%$ | \% within IS $=58.3 \%$ |
|  | \% within $\mathrm{G}=55.2 \%$ | \% within G $=44.8 \%$ | \% within $\mathrm{G}=100.0 \%$ |
|  | $\%$ of Total $=32.2 \%$ | $\%$ of Total $=26.1 \%$ | $\%$ of Total $=58.3 \%$ |
| Female | $\mathrm{n}=16$ | $\mathrm{n}=32$ | $\mathrm{n}=48$ |
|  | \% within IS $=30.2 \%$ | \% within IS $=51.6 \%$ | \% within IS $=41.7 \%$ |
|  | \% within $\mathrm{G}=33.3 \%$ | \% within $\mathrm{G}=66.7 \%$ | \% within $\mathrm{G}=100.0 \%$ |
|  | $\%$ of Total $=13.9 \%$ | $\%$ of Total $=27.8 \%$ | $\%$ of Total $=41.7 \%$ |
| Total | $\mathrm{n}=53$ | $\mathrm{n}=62$ | $\mathrm{n}=115$ |
|  | \% within IS $=100.0 \%$ | \% within IS $=100.0 \%$ | \% within IS $=100.0 \%$ |
|  | \% within $\mathrm{G}=46.1 \%$ | \% within G $=53.9 \%$ | \% within $\mathrm{G}=100.0 \%$ |
|  | $\%$ of Total $=46.1 \%$ | \% of Total $=53.9 \%$ | $\%$ of Total $=100.0 \%$ |

The chi-square test value was $5.393(d f=1, \mathrm{n}=115)$, which was significant ( $p=.01$ for a one-sided test) and had the minimum expected count of 22.12 , indicating the calculated chi-square is appropriate. ${ }^{2}$ The results show that males and females chose different information sources for decisions, thereby supporting hypothesis 1. In particular, $55.2 \%$ of males used personal/family sources, versus $33.3 \%$ of females. The use of outside

[^6]sources (magazines and brokers) was $44.8 \%$ for males and $66.7 \%$ for females. These results show that males use personal/family sources more often while females use outside sources more frequently.

## Test of Hypothesis 2

Hypothesis 2 states that the risk attitudes of beginning educated investors have no effect on the type of information source they use for investment decisions. Out of 129 participants, 27 stated they were risk-averse, 67 risk-neutral, and 32 risk-taker for a total of 126 usable responses. Table 2 presents the $2 \times 3$ contingency table for information source and risk attitudes.

Table 2: Cross Tabulation of Risk Attitudes by Information Source

|  | Personal/Family Knowledge | Outside Sources Magazine/Broker | Total |
| :---: | :---: | :---: | :---: |
| Risk-averse | $\mathrm{n}=12$ | $\mathrm{n}=15$ | $\mathrm{n}=27$ |
|  | \% within IS $=20.0 \%$ | \% within IS $=22.7 \%$ | \% within IS $=21.4 \%$ |
|  | \% within $\mathrm{RA}=44.4 \%$ | \% within RA $=55.6 \%$ | \% within $\mathrm{RA}=100.0 \%$ |
|  | $\%$ of Total $=9.5 \%$ | $\%$ of Total $=11.9 \%$ | $\%$ of Total $=21.4 \%$ |
| Risk-neutral | $\mathrm{n}=28$ | $\mathrm{n}=39$ | $\mathrm{n}=67$ |
|  | \% within IS $=46.7 \%$ | \% within IS = 59.1\% | \% within IS = 53.2\% |
|  | \% within $\mathrm{RA}=41.8 \%$ | \% within RA=58.2\% | \% within RA= 100.0\% |
|  | $\%$ of Total $=22.2 \%$ | $\%$ of Total $=31.0 \%$ | $\%$ of Total $=53.2 \%$ |
| Risk-taker | $\mathrm{n}=20$ | $\mathrm{n}=12$ | $\mathrm{n}=32$ |
|  | \% within IS $=33.3 \%$ | \% within IS $=18.2 \%$ | \% within IS = 25.4\% |
|  | \% within $\mathrm{RA}=62.5 \%$ | \% within RA= 37.5\% | \% within $\mathrm{R}=100.0 \%$ |
|  | $\%$ of Total $=15.9 \%$ | $\%$ of Total $=9.5 \%$ | $\%$ of Total $=25.4 \%$ |
| Total | $\mathrm{n}=60$ | $\mathrm{n}=66$ | $\mathrm{n}=126$ |
|  | \% within IS $=100.0 \%$ | \% within IS $=100.0 \%$ | \% within IS = 100.0\% |
|  | \% within RA= 47.6\% | \% within RA $=52.4 \%$ | \% within RA= 100.0\% |
|  | $\%$ of Total $=47.6 \%$ | $\%$ of Total $=52.4 \%$ | $\%$ of Total $=100.0 \%$ |

The chi-square test value was $3.862(D F=2, \mathrm{n}=126)$, which was not significant ( $p=.073$ for one-sided test) and had the minimum expected count of 12.86 , indicating the calculated chi-square is appropriate. The results show that risk attitudes of participants had no effect on how participants chose different information sources for investment decisions. Therefore, hypothesis 2 was not supported.

## Test of Hypothesis 3

Hypothesis 3 posits that there is no interaction between gender and risk attitudes of beginning educated investors affecting the type of information source they use for investment decisions. Tables 3 and 4 present the $2 \times 3$ contingency tables of the interaction effect. Table 3 shows gender by risk attitudes for personal/family information sources, and Table 4 shows gender by risk attitudes for broker/magazine information sources.

The chi-square test value for personal/family information sources was $12.847(d f=2, \mathrm{n}=115)$, which was significant ( $p=.001$ for the one-sided test) and had the minimum expected count of 2.72 , indicating one cell had an expected count of less than 5 . The chi-square test value for broker/magazine information sources was 2.485 ( $d f=2, \mathrm{n}=115$ ), which was not significant ( $p=.145$ for the one-sided test) and had the minimum expected count of 4.84 , indicating one cell had an expected count of less than 5 . The chi-square test value for total was $15.979(d f=1, \mathrm{n}=115)$, which was significant ( $p=.000$ for the one-sided test) and had the minimum expected count of 9.60 , indicating that the calculated chi-square is appropriate. ${ }^{3}$ The results show an interaction between gender and risk attitudes affecting information source, which supports hypothesis 3 . Tables 3 and 4 show similar percentages of males and females who are risk-averse or risk-neutral; both groups chose either personal/family or broker/magazine information sources. Tables 3 and 4 also indicate that males are more

[^7]risk-taking than females, choosing more personal/family information sources than broker/magazine information sources.

Table 3: Cross Tabulation of Gender by Risk Attitudes (Personal/Family Information Source)

|  | Female | Male | Total |
| :---: | :---: | :---: | :---: |
| Risk-averse | $\mathrm{n}=4$ | $\mathrm{n}=5$ | $\mathrm{n}=9$ |
|  | \% within $\mathrm{RA}=44.4 \%$ | \% within RA $=55.6 \%$ | \% within $\mathrm{RA}=100.0 \%$ |
|  | \% within $\mathrm{G}=25.0 \%$ | \% within $\mathrm{G}=13.5 \%$ | \% within $\mathrm{G}=17.0 \%$ |
|  | $\%$ of Total $=7.5 \%$ | $\%$ of Total $=9.4 \%$ | $\%$ of Total $=17.0 \%$ |
| Risk-neutral | $\mathrm{n}=12$ | $\mathrm{n}=13$ | $\mathrm{n}=25$ |
|  | \% within RA $=48.0 \%$ | \% within RA $=52.0 \%$ | \% within $\mathrm{RA}=100.0 \%$ |
|  | \% within G = 75.0\% | \% within $\mathrm{G}=35.1 \%$ | \% within G = 47.2\% |
|  | \% of Total $=22.6 \%$ | $\%$ of Total $=24.5 \%$ | $\%$ of Total $=47.2 \%$ |
| Risk-taker | $\mathrm{n}=0$ | $\mathrm{n}=19$ | $\mathrm{n}=19$ |
|  | \% within RA $=0 \%$ | \% within RA= 00.0\% | \% within RA $=100.0 \%$ |
|  | $\%$ within $\mathrm{G}=0 \%$ | \% within $\mathrm{G}=51.4 \%$ | \% within G = 35.8\% |
|  | $\%$ of Total $=0 \%$ | \% of Total $=35.8 \%$ | $\%$ of Total $=35.8 \%$ |
| Total | $\mathrm{n}=16$ | $\mathrm{n}=37$ | $\mathrm{n}=53$ |
|  | \% within RA $=30.2 \%$ | \% within RA $=69.8 \%$ | \% within RA $=100.0 \%$ |
|  | \% within $\mathrm{G}=100.0 \%$ | \% within $\mathrm{G}=100.0 \%$ | \% within $\mathrm{G}=100.0 \%$ |
|  | \% of Total $=30.2 \%$ | $\%$ of Total $=69.8 \%$ | $\%$ of Total $=100.0 \%$ |

Table 4: Cross Tabulatioin of Gender by Risk Attitudes (Broker/Magazine Information Source)

|  | Female | Male | Total |
| :---: | :---: | :---: | :---: |
| Risk-averse | $\mathrm{n}=7$ | $\mathrm{n}=7$ | $\mathrm{n}=14$ |
|  | \% within RA $=50.0 \%$ | \% within RA $=50.0 \%$ | \% within RA= 100.0\% |
|  | \% within $\mathrm{G}=21.9 \%$ | \% within $\mathrm{G}=23.3 \%$ | \% within $\mathrm{G}=22.6 \%$ |
|  | $\%$ of Total $=11.3 \%$ | $\%$ of Total $=11.3 \%$ | \% of Total $=22.6 \%$ |
| Risk-neutral | $\mathrm{n}=22$ | $\mathrm{n}=16$ | $\mathrm{n}=38$ |
|  | \% within RA $=57.9 \%$ | \% within RA $=42.1 \%$ | \% within RA $=100.0 \%$ |
|  | \% within $\mathrm{G}=68.8 \%$ | \% within $\mathrm{G}=53.3 \%$ | \% within $\mathrm{G}=61.3 \%$ |
|  | $\%$ of Total $=35.5 \%$ | $\%$ of Total $=25.8 \%$ | $\%$ of Total $=61.3 \%$ |
| Risk-taker | $\mathrm{n}=3$ | $\mathrm{n}=7$ | $\mathrm{n}=10$ |
|  | \% within RA $=30.0 \%$ | \% within RA $=70.0 \%$ | \% within RA= 100.0\% |
|  | \% within $\mathrm{G}=9.4 \%$ | \% within $\mathrm{G}=23.3 \%$ | \% within $\mathrm{G}=16.1 \%$ |
|  | $\%$ of Total $=4.8 \%$ | $\%$ of Total $=11.3 \%$ | $\%$ of Total $=16.1 \%$ |
| Total | $\mathrm{n}=32$ | $\mathrm{n}=30$ | $\mathrm{n}=62$ |
|  | \% within RA $=51.6 \%$ | \% within RA $=48.4 \%$ | \% within RA= 100.0\% |
|  | \% within $\mathrm{G}=100.0 \%$ | \% within $\mathrm{G}=100.0 \%$ | \% within $\mathrm{G}=100.0 \%$ |
|  | \% of Total $=51.6 \%$ | \% of Total $=48.4 \%$ | \% of Total $=100.0 \%$ |

## Test of Hypothesis 4

Hypothesis 4 states that the GPA of beginning business-educated investors has no effect on the type of information source they use for investment decisions. Since the independent variable was a continuous variable, binary logistic regression was used to test this hypothesis. The results show that GPA did not predict well the information source participants used (Nagelkerke R-Square $=.016$ ) and was not significant (Wald test $=1.429, d f=1, \mathrm{n}=121, p=.23)$. Therefore, hypothesis 4 cannot be rejected.

## Test of Hypothesis 5

Hypothesis 5 posits that the particular type of business major of beginning educated investors does not affect the type of information source they use for investment decisions. We grouped business majors into three categories for this analysis: accounting; finance; and other business majors. Out of 126 participants who
responded to the major question, 36 were accounting students, 41 were finance students, and 49 were other business majors. Table 5 presents the $2 \times 3$ contingency table for information source and business major. ${ }^{4}$

The chi-square test value was $12.886(d f=2, \mathrm{n}=126)$, which was significant ( $p=.001$ for the one-sided test) and had the minimum expected count of 17.14 , indicating the calculated chi-square is appropriate. The results showed that participants with different majors chose different information sources for decisions; these results support hypothesis 5 . In particular, $25.0 \%$ of accounting majors used personal/family sources in comparison with $65.9 \%$ of finance majors and $49.0 \%$ of other business majors. The use of outside sources (magazine and brokers) was $75.0 \%$ for accounting majors, $34.1 \%$ for finance majors, and $51.0 \%$ for other business majors. Table 5 shows the cross tabulation results.

The results indicate that accounting major participants tended to use broker/magazine information sources more often. On the other hand, finance major participants tended to use personal/family information sources more frequently. Other business majors made roughly equal use of personal/family and outside broker/magazine advice for investment decisions.

Table 5: Cross Tabulation of Business Majors by Information Source

| Major | Personal/Family Knowledge | Outside Sources Magazine/Broker | Total |
| :---: | :---: | :---: | :---: |
| Accounting | $\mathrm{n}=9$ | $\mathrm{n}=27$ | $\mathrm{n}=36$ |
|  | \% within IS = 15.0\% | \% within IS $=40.9 \%$ | \% within IS $=28.6 \%$ |
|  | \% within $\mathrm{BM}=25.0 \%$ | \% within $\mathrm{BM}=75.0 \%$ | \%within $\mathrm{BM}=100.0 \%$ |
|  | \% of Total $=7.1 \%$ | $\%$ of Total $=21.4 \%$ | \% of Total $=28.6 \%$ |
| Finance | $\mathrm{n}=27$ | $\mathrm{n}=14$ | $\mathrm{n}=41$ |
|  | \% within IS = 45.0\% | \% within IS $=21.2 \%$ | $\%$ within IS $=32.5 \%$ |
|  | \% within $\mathrm{BM}=65.9 \%$ | \% within $\mathrm{BM}=34.1 \%$ | \% within $\mathrm{BM}=100.0 \%$ |
|  | $\%$ of Total $=21.4 \%$ | $\%$ of Total $=11.1 \%$ | $\%$ of Total $=32.5 \%$ |
| Other Business | $\mathrm{n}=24$ | $\mathrm{n}=25$ | $\mathrm{n}=49$ |
|  | \% within IS $=40.0 \%$ | \% within IS $=37.9 \%$ | $\%$ within IS $=38.9 \%$ |
|  | \% within $\mathrm{BM}=49.0 \%$ | \% within $\mathrm{BM}=51.0 \%$ | \% within $\mathrm{BM}=100.0 \%$ |
|  | $\%$ of Total $=19.0 \%$ | $\%$ of Total $=19.8 \%$ | $\%$ of Total $=38.9 \%$ |
| Total | $\mathrm{n}=60$ | $\mathrm{n}=66$ | $\mathrm{n}=126$ |
|  | \% within IS $=100.0 \%$ | \% within IS $=100.0 \%$ | $\%$ within IS $=100.0 \%$ |
|  | \% within $\mathrm{BM}=47.6 \%$ | \% within $\mathrm{BM}=52.4 \%$ | \% within $\mathrm{BM}=100.0 \%$ |
|  | $\%$ of Total $=47.6 \%$ | $\%$ of Total $=52.4 \%$ | $\%$ of Total $=100.0 \%$ |

## Further Analysis

To better understand the investment decisions of novice business-educated investors, we used four groups of investment information resources: 1) personal reading and analyzing of financial statement, 2) magazines, 3) brokers, and 4) family advice in order to examine how gender and education affect the use of these investment decision sources. For gender, the chi-square test value was $11.010(d f=3, \mathrm{n}=115)$, which was significant ( $p=.006$ for the one-sided test) and had the minimum expected count of 6.26 , indicating the calculated chi-square is appropriate. The results show that males used personal reading and analyzing of financial statements at a rate of $38.8 \%$, magazines at $14.9 \%$, brokers at $29.9 \%$, and family advice at $16.4 \%$. On the other hand, females used personal reading and analyzing of financial statements at a rate of $14.5 \%$, magazines at $10.4 \%$, brokers at $56.3 \%$, and family advice at $18.8 \%$. These results show that males rely more on their personal reading and analyzing of financial statements, whereas females use brokers more frequently.

The findings for education showed that the chi-square test value was $17.615(d f=6, \mathrm{n}=126)$, which was significant ( $p=.004$ for the one-sided test) and had the minimum expected count of 4.86 , indicating one cell had an expected count of less than 5 . The results show that $46.3 \%$ of finance majors used personal reading and analyzing of financial statements, followed by $24.5 \%$ of other business majors and $13.9 \%$ of accounting majors. Accounting majors used magazines $22.2 \%$ of the time, followed by finance majors at $12.2 \%$ and other business majors at $8.2 \%$. In comparison, $52.8 \%$ of accounting majors used brokers, followed by other

[^8]business majors at $42.8 \%$ and finance majors at $22.0 \%$. Finally, other majors used family advice at a rate of $24.5 \%$ followed by finance majors at $19.5 \%$ and accounting majors at $11.1 \%$. These results indicate that finance majors use personal reading and analyzing of financial statements more often, whereas accounting students and other business majors use brokers more frequently.

## Summary and Conclusion

In this study, we examine the information sources which beginning business-educated investors employ to make investment decisions. One hundred twenty-nine business students in the last semester of their bachelor's degree participated in the study and completed a questionnaire which asked about students' use of different types of information sources and their demographic characteristics. The results show that risk attitudes and GPA had no effect of the use of information source for investment decisions. The findings also indicate that gender and type of business major affected the use of information sources for investment decisions. In addition, risk attitudes and gender interaction affected the use of information sources for investment decisions.

We find that males use more personal/family information sources, whereas females use more outside broker and magazine information sources for investment decisions. In addition, males are more risk-taking than females, and that may explain why they chose personal/family information sources more often than outside broker/magazine information sources. An interesting finding of the study is that finance majors reported that they would use personal/family information sources, while accounting students would use outside broker/magazine information sources. Finance students are trained in financial statement analysis, possibly explaining why these students chose to rely more often on personal/family information sources for investment decisions. On the other hand, accounting students are trained to mechanically prepare the financial statements. Therefore, they are inclined to choose outside sources for making investment decisions.

The findings of this study contribute to the literature by examining several factors affecting the use of information sources for decisions, including factors not examined in previous studies such as GPA, choice of business major, and interaction between gender and risk attitudes. The findings of this study also extend the gender literature, investigating the difference between males and females in investment decisions. In addition, a primary difference between this study and previous ones is that our student investors are neither expert nor naïve. Our subjects were business students who were somewhat familiar with corporate annual reports and the functioning of financial markets. The students had finished both accounting and finance courses as proxies for beginning investors who can read and understand financial statements and markets. However, our subjects were not equally financially literate; for example, accounting and finance majors typically take more finance courses compared to the management and marketing students. Therefore, a notable contribution of our study is that the information sources used in investment decisions help us understand information utilization by these business-educated young investors.

We do note several limitations of the study. First, we use students as surrogates for the real investors; thus, the usual caveat for such studies applies. Second, the results may not be generalizable to other settings. Student participants in this study attend a college with very competitive admissions standards. Business students at the college have average total SAT scores of 1,300 and are from top $10 \%$ of high school graduates. Third, other sources of investment decisions, such as online information, are not used in this study. Future studies may examine these other sources of information. Fourth, students in this study self-reported their risk attitudes. Alternatively, risk attitudes could have been estimated using lotteries (Donkers et al. 2001) where it was reported that attitudes toward risk are associated with certain observed individual attributes. The study by Dohmen et al. (2011, p. 524) used both a lottery and the self-reported question of "How willing are you to take risks, in general?" and found that both measures associated strongly with individual characteristics of gender, age, height, and parental background. Therefore, the self-reported measure of risk attitude seems warranted in this study. Fifth, this study assumes that students are novice business-educated investors. While there is no reason to believe any of the students in our study were expert investors (a belief supported by the student demographic at the college where this study was conducted), it is possible that a few of the students may have had prior investment experience. Future studies should consider this issue and add a measurement question to find the expertise of participants in investment decisions. Finally, the same limitations of survey research apply to this study.

This study was conducted when the stock market was doing well. An extension of this study would investigate whether the findings of this study will hold after a market crash. We also examined the differences
among accounting, finance, and other business majors due to the small sample size for other majors. An extension of this study could be conducted with a larger sample size and investigate whether other categories of business major (e.g., marketing, management, or economics) use information sources differently for investment decisions. In addition, this study used senior undergraduate students since we did not have any MBA students. This study can be replicated with MBA students. Finally, this study can be replicated in other cultures.

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## Appendix: Survey Questionnaire

Suppose you have inherited $\$ 50,000$ and you would like to invest it (i.e., bonds, stocks, mutual bonds, mutual stocks, etc.). What is the most likely way you would make your investment decision (check one)?

Read and analyze financial statements yourself
Use magazine advices
Use Brokers
Use family advices
Other (Explain): $\qquad$

1. Suppose you have inherited $\$ 50,000$ and you would like to invest it. Please choose how you will invest the money under any of the following conditions (If you choose multiple investments, your total should add up to $\$ 50,000$ ):

Condition 1: You want to invest the money short term (for one year).
Condition 2: You want to invest the money mid-range (for 3 to 5 years).
Condition 3: You want to invest the money long-term (for more than five years).

| Type of Investment | Condition | Condition 2 | Condition 3 |
| :---: | :---: | :---: | :---: |
| Bank Savings/CDs | \$ | \$ | \$ |
| Bonds |  |  |  |
| Stocks |  |  |  |
| Bonds Mutual Funds |  |  |  |
| Stocks Mutual Funds |  |  |  |
| Other (Explain): |  |  |  |
| Total | \$50,000 | \$50,000 | \$50,000 |

2. What is the most likely way you would make your investment decision (check one)?

Read and analyze financial statements yourself
Use business magazine/journal advice
Use Brokers
Use family advice
Track Stocks Yourself
Other (Explain): $\qquad$
$\qquad$

## Background Information

Your age $\qquad$
Are you:
Single
Are you:
Female
$\ldots$
Male
Married
Your overall grade point average up to now (e.g., 4.00, 3.57, 2.48, etc.): $\qquad$
You are: ___ Risk-averse ___ Risk-neutral ___ Risk-taker
Your Major: ___ Accounting $\quad$ Management $\quad$ Finance $\quad$ Economics $\quad$ Marketing Interdisciplinary Business (General Business) —_O Other (specify)

# An Examination of the Sustainability of Fixed-Exchange-Rate Systems using the Mundell-Fleming Model 

R. Stafford Johnson and Amit Sen ${ }^{1}$


#### Abstract

The seminal Mundell-Fleming model has served not only as a template for research in international macroeconomics, but also as an important pedagogical tool. Their earlier work on the fixed-exchange rate system was particularly important in explaining the Bretton Woods system and how inconsistent policies led to the system's collapse. Their model is also important today in explaining how surplus countries like China use their international reserves to keep their currencies relatively fixed at a devalued level. This paper re-examines the Mundell-Fleming fixedexchange rate model to identify and highlight the economic factors fundamental to the sustainability of today's exchange-rate system.


## Introduction

Under the Bretton Woods fixed-exchange-rate system, a deficit country was required to intervene in the currency market to stop its exchange rate from increasing by using its international reserve holdings. The equilibrium adjustment then worked through changes in the money supply and international reserves. This system, however, led to persistent external imbalances amongst countries that had inconsistent stabilization policies. For example, a deficit country fighting unemployment with expansionary monetary and fiscal policies found its policies offsetting the normal monetary contraction and balance of payments correction resulting from the deficit. These countries would eventually run out of the international reserves needed to maintain the system.

This was the case in the late 1960s as U.S. economic policies turned highly expansionary (government financing of "The Great Society" programs and the Vietnam War). During this period, the US federal budget shifted into deficit, while the Federal Reserve pursued an accommodating monetary policy, supplying liquidity to the financial system. U.S. interest rates rose as the economy boomed, but not enough to contain inflation, which accelerated to $4 \%$. The U.S.'s monetary and fiscal policies also created problems in Europe, especially in Germany, Netherlands, and Switzerland, where the primary objective of monetary policy was to keep inflation low, typically at $2 \%$ or less. These countries accumulated international reserves, as their trade surpluses expanded, and their domestic money supplies expanded as exporters exchanged dollars for domestic currency. The Bundesbank, Swiss National Bank, and other central banks attempted to counter this trend by draining liquidity from the financial system. However, the upward pressure on European interest rates attracted international capital flows from abroad, which made it increasingly difficult for these central banks to control their money supplies. In 1973, the U.S. announced that it would no longer support its currency. This marked the collapse of the fixed-exchange-rate system and the de facto move to the flexible-exchange-rate system. In retrospect, the Bretton-Woods system was unsustainable. ${ }^{2}$

Under the current flexible system, the equilibrium adjustment to an external imbalance occurs through changes in the exchange rate and money supply. However, under a flexible system, persistent imbalances can

[^9]also occur because of inconsistent stabilization policies. For example, a country with a central bank policy of sterilizing its reserves to keep its currency devalued and its exports high often finds itself with a persistent balance of payments surplus. This is the case in China, which has maintained large international reserve holdings, a stable but devalued currency, and persistent surpluses. For China and its trading partners, such policies have led to a de facto fixed-exchange-rate system. For the last twenty years, U.S. Administrations from Bush to Obama to Trump have pressured China with trade restrictions to float its currency against the U.S. dollar to make U.S. goods more competitive in the global market. Just as the Bretton Woods system collapsed because of inconsistent policies, a de facto fixed system may also be unsustainable if it leads to deficit countries retaliating with trade restrictions against what they see as currency manipulation.

## Objective

For over forty years, the Mundell-Fleming model has been used as a template for research in international macroeconomics. As Frenkel and Razin (1987) point out, their model provides an explanation of how international capital flows and monetary changes work to restore internal and external equilibria. ${ }^{3}$ The Mundell-Fleming model is often used to explain how alternative exchange rate systems operate and how the different systems impact the effectiveness of monetary, fiscal, and trade policies on an economy. The earlier works by Mundell (1960, 1961, 1962, 1963, and 1968) and Fleming (1962) on the fixed-exchange rate system are particularly important in explaining the monetary adjustment to an imbalance under the Bretton Woods system and how inconsistent policies led to the system's collapse. More recently, their model has been used to explain how countries in the European Monetary Union lost their monetary control and the policy implications such a loss had on countries like Greece when they were faced with economic stagnation, how the 1994-1995 Mexican financial crisis forced the Mexican central bank to devalue its pegged currency after it lost its dollar reserves, and the how the 1997-1998 Asian financial crisis impacted Thailand, South Korea, and Indonesia (see Mankiw 2013). Today, the Mundell-Fleming fixed-exchange rate model is important in explaining how surplus countries like China use their international reserves to keep their currencies relatively fixed at a devalued level.

The Mundell-Fleming model is also a valuable pedagogical model for explaining international macroeconomics. The model is presented in several international and macroeconomic texts (Mankiw 2013; Appleyard et al. 2005; and Pugel 2004), and is even included as prep material for the Chartered Financial Analyst (CFA) level 2 exam. Mankiw provides a formal presentation of their flexible and fixed models for a small open economy with perfect capital mobility. He explains their model in terms of an IS/LM analysis defined in terms of the exchange rate and real income, with the exogenous variables being world interest rates, the price level, and monetary, fiscal, and trade policies. Another excellent exposition of their fixed model can be found in an early edition of William Branson's macroeconomic text (1972). Krugman et al. (2018), in their international text, examine macroeconomic policies using aggregate demand and supply curve analysis for an open economy that incorporates elements based on the Mundell-Fleming flexible model. Similar policy analysis can also be found in Feenstra's and Taylor's international macroeconomic texts (2016). In 2006, Johnson et al. (2006) explained the Mundell-Fleming flexible exchange-rate model by combining their model with the Keynesian-Hicksian IS/LM and aggregate supply and demand curve model. Different from Mankiw's presentation with two sectors, Johnson et al. derive a four-sector model (expenditure, production, wealth, and external sectors) with four endogenous variables (real income, the price level, the interest rate, and the exchange rate).

The purpose of this paper is to re-examine the seminal Mundell-Fleming fixed-exchange rate model to identify and highlight the economic factors fundamental to the sustainability of today's exchange-rate system. The next section summarizes their flexible model as presented by Johnson et al. Given this model, the
exchange reserves, and they increasingly sold their dollars for gold. By the summer of 1971, U.S. official holdings of gold, which totaled nearly $\$ 30$ billion at the end of World War II, were down to just over $\$ 10$ billion, and hundreds of millions of dollars were being withdrawn each month. In 1971, President Nixon announced that the U.S. was closing the gold window, and in 1972 and 1973, the U.S. devalued the dollar by allowing its value to be determined in the foreign currency market. For good discussions of this period, see Sargen (2016), Krugman et al. (2018), Chapter 18, and Feenstra and Taylor (2016), Chapters 8 and 9.
${ }^{3}$ The Mundell-Fleming Model and related works represent an extension of the seminal work of James Meade. Meade's treatise on the balance of payments combined Keynesian economic conditions with monetary factors to explain the balance of payments, the economic impacts of devaluations, and the factors governing the fixed and flexible exchange rate system.

Mundell-Fleming model is then extended to explain the fixed-exchange-rate system and the equilibrium adjustment process. The paper concludes by questioning the sustainability of today's exchange-rate system.

## Mundell-Fleming Flexible-Exchange-Rate Model

The Mundell-Fleming market model combines the traditional Keynesian-Hicksian macroeconomic model with a balance of payment model. The model can be defined in terms of an economy's internal and external equilibrium conditions. In the Keynesian-Hicksian model, the internal equilibrium occurs at an aggregate real output level, $y$, interest rate, $r$, and price level, $P$, in which supply and demand are equal in both the goods and capital markets. Graphically, this equilibrium occurs at the intersection of the IS and LM curves and the aggregate supply and demand curves, SS and DD (see Exhibit 1).

In terms of the Mundell-Fleming model, a country's external balance is explained in terms of a balance of payments function and the internal equilibrium conditions determining real income, interest rates, and prices. Equation (1) defines a balance of payments function in which the external balance, $B$, is expressed in terms of the money values of exports, $X$, imports, $M$, and net capital flows, $F^{n}$ :

$$
\begin{equation*}
B=X-M+F^{n}=X\left(P, E_{0}\right)-M\left(y, P, E_{0}+F^{n}(r)\right. \tag{1}
\end{equation*}
$$

The money value of exports, $X$, is assumed to depend on the domestic price level and the spot exchange rate expressed in terms of the amount of domestic currency needed to buy one unit of foreign currency. The partial of exports with respect to the price level can be either positive or negative; its sign depends on the price elasticity of real export spending. The partial of exports with respect to the exchange rate, though, is assumed to be positive. The money value of imports, $M$, is assumed to be a function of real income, $y$, the price level, and the exchange rate. Both the partial of imports with respect to real income and the partial with respect to prices are assumed to be positive; the sign of the latter partial reflects a substitution effect. The partial of imports with respect to the exchange rate is shown to be either positive or negative; its sign depends on the elasticity of real imports with respect to the exchange rate. To avoid the complications associated with reciprocal impacts, foreign prices, interest rates, and real income are assumed constant. For simplicity, it is also assumed that there are no expenditure-switching variables such as tariffs, exchange controls, and the like, that direct investment has no impact on the balance of payments, and that investors treat short-term and long-term investments as the same. ${ }^{4}$

Graphically, the import and export functions give rise to the MX curve shown in quadrant IV of Exhibit 1. This curve shows the relationship between $M-X$ and $y$ for given price and exchange rate levels. The slope of the MX curve is the marginal propensity to import, $\partial M / \partial y$, and the position of the curve is determined by $P$ and $E_{0}$. Depending on the price elasticity of real exports, a price change in the economy will shift the MX curve either up or down by $\partial(M-X) / \partial P$. If the elasticity is greater than one in absolute value, then a price increase will lead to a decrease in the money value of exports. This decrease, combined with a decrease in the money value of imports resulting from a substitution effect, will increase $M-X$, leading to a downward shift in the MX curve. Similarly, depending on the exchange-rate elasticity of real imports, a change in the exchange rate will shift the MX curve either up or down by $\partial(M-X) / \partial E_{0}$. If the elasticity is greater than one in absolute value, then an increase in the exchange rate will decrease the money value of imports (valued in terms of domestic currency). The increase in the exchange rate will also lower the foreign currency price of exports, increasing export demand and the money value of exports (valued in domestic currency). The combined effects of the exchange-rate increase will therefore be a decrease in $M-X$, leading to an upward shift in the MX curve.

The final function in Equation (1) is net capital flows, $F^{n}$. For simplicity, net capital flows, capital inflows, $F^{i}$, minus capital outflows, $F^{o}$, are assumed to depend only on the domestic interest rate, $r$. The derivative of net capital flows with respect to the interest rate is assumed to be positive. That is, a rise in the domestic rate is assumed to increase the purchases of existing financial assets by foreigners ( $F^{i}$ ), and through a substitution effect, decrease the purchases of foreign assets by residents $\left(F^{\circ}\right)$. Graphically, the net capital flows function

[^10]gives rise to the FF curve shown in the quadrant I of Exhibit 1. The curve shows the positive relationship between $F^{n}$ and $r$, where the slope of FF is $\partial F^{n} \partial r$.

Exhibit 1: Mundell-Fleming and Keynesian-Hicksian Flexible-Exchange-Rate Model


Under a flexible-exchange-rate system, the external equilibrium occurs at $y, P$, $r$, and $E_{0}$ levels in which the balance of payments is zero. This condition is shown in quadrant III where the external equilibrium condition of $F^{n}=M-X($ or $B=0)$ is specified by the $45^{\circ}$ line. Graphically, the external equilibrium condition requires the coordinate $M-X$ and $F^{n}$ to be on the $45^{\circ}$ line; if $F^{n}>M-X$, the coordinate is above the line and there is a surplus; if $F^{n}<M-X$, the coordinate is below the line and there is a deficit. The external equilibrium condition of $B=0$ is also equivalent to the supply, $S^{F C}$, and demand, $D^{F C}$, for foreign currency, $F C$, being equal in the foreign currency market. In terms of this model, the supply of $F C$ is determined by exports and capital inflows, which, in turn, are functions of the exchange rate, prices, and interest rates; the demand for $F C, D^{F C}$, is determined by imports and capital outflows, which, in turn, depend on the exchange rate, real income, prices, and interest rates:

$$
\begin{align*}
& S^{F C}=X\left(P, E_{0}\right)+F^{i}(r)  \tag{2}\\
& D^{F C}=M\left(y, P, E_{0}\right)+F^{o}(r)
\end{align*}
$$

These functions give rise to the supply and demand curves for foreign currency, $\mathrm{S}^{f} \mathrm{~S}^{f}$ and $\mathrm{D} \mathbf{D}$, also shown in Exhibit 1

For a flexible-exchange-rate system, total equilibrium occurs at the $y^{*}, P^{*}, r^{*}$, and $E_{0}{ }^{*}$ levels in which the economy is simultaneously in internal and external equilibrium. This is shown in Exhibit 1 where $y_{0}{ }^{*}$, $P_{0}{ }^{*}, r_{0}{ }^{*}$, and $E_{0}{ }^{*}$ levels are defined by the intersections of the IS and LM curves and SS and DD curves, and where $M-X$ and $F^{n}$ levels are equal; that is, the $(M-X)_{0}$ and $F_{0}{ }^{n}$ coordinate is on the $45^{\circ}$ line. The total equilibrium condition is also shown in the accompanying foreign currency supply and demand figure where the $\mathrm{S}^{f} \mathrm{~S}^{f}$ and $\mathrm{DD}^{f}$ curves intersect at $E_{0}{ }^{*}$ and the positions of the $\mathrm{S}^{f} \mathrm{~S}^{f}$ and $\mathrm{D}^{f} \mathrm{D}^{f}$ curves are defined by $y_{0}{ }^{*}, P_{0}{ }^{*}$, and $r_{0} *$ levels that satisfy the internal equilibrium condition.

Under a flexible-exchange rate system, the equilibrium adjustment to a balance of payments deficit or surplus initially occurs through changes in the exchange rate and the money supply. In the foreign currency market, a deficit reflects an excess demand for FC. This excess demand increases the exchange rate and decrease the country's money supply as its banks and financial institutions go into the currency market to buy FC with their local currency holdings. On the other hand, if a country has a surplus, then it will be reflected by an excess supply of FC. This excess lowers the exchange rate and increases the FC holdings of the country's banks and financial institutions. If banks and financial institutions subsequently convert their FC holdings to local currency, then the money supply will increase. ${ }^{5}$ In a Mundell-Fleming model, the equilibrium adjustment to a deficit or surplus starts with the balance of payments changing in response to the change in the exchange rate and the changes in $y, P$, and $r$ resulting from the change in the money supply.

## The Mundell-Fleming Fixed-Exchange-Rate Model

In general, when a country has a balance of payments deficit, the deficit can have three economic impacts:

1. The money supply can decrease as domestic banks go into the foreign currency market to buy currency; this results in a local currency outflow.
2. The deficit, by increasing the demand for foreign currency (FC), can cause the price of FC $\left(E_{0}\right)$ to increase.
3. International reserves can decrease if the central bank sells its FC to banks or intervenes into the exchange market to buy its currency with its FC reserves.

When a country has a balance of payments surplus, the surplus can have the opposite impacts:

1. Foreign currency holdings can increase. With a surplus, local banks will be selling local currency to foreigners (or their banks). The foreigners then use the currency to buy imports or foreign capital. These actions would not necessarily change the money supply since foreigners would be buying the local currency from banks and then using the currency to buy their imports or foreign capital. The surplus would, however, increase the FC holdings of local banks. If the local banks were to convert the FC to local currency (with the central bank or with foreign banks), then the money supply would increase.
2. The surplus can cause the FC price of the local currency to increase as foreigners try to buy local currency with their currency.
3. The surplus can cause the international reserves of the central bank to increase if banks sell their FC to the central bank.

In a fixed-exchange-rate system, the equilibrium adjustment works through changes in the money supply. This monetary adjustment to a deficit or surplus was first pointed out by the Canadian economist Harry Johnson (1972) and then later used to explain the Mundell-Fleming equilibrium adjustment process under a fixed-exchange-rate system. ${ }^{6}$

Equilibrium in the Mundell-Fleming fixed-exchange rate model occurs at $y^{*}, P^{*}$, and $r^{*}$ where we have an internal equilibrium (IS/LM and SS/DD) and an external equilibrium ( $B=0$ or $M-X=F^{n}$ ). If the country has sufficient reserves to maintain its exchange rate, then under the Bretton Woods system, the country's central bank would intervene in the market to buy its currency with reserves. Thus in the foreign exchange market, the exchange rate is fixed or stable, fluctuating within a permitted band. If the balance of payments

[^11]were not equal to zero, then with the exchange rate fixed, the external equilibrium adjustment would come via a change in the money supply causing $y, P$, and $r$ to change. For example, a deficit would cause the money supply to decrease. The contraction in the money supply, in turn, would cause real income to decrease, prices to decrease, and interest rates to increase. The income and price decreases and the rate increase would work in the same direction to correct the deficit. That is, the income decrease would lower imports, the price decrease would increase exports and lower imports (assuming elasticity conditions hold), and the interest rate increase would augment net capital flows. A surplus, in contrast, would cause foreign currency holdings to increase, which would cause the money supply to increase if it is converted. The expansion in the money supply (if allowed by the central bank) would cause real income and prices to increase and interest rates to decrease. The income increase would augment imports, the price increase would increase imports and decrease exports, and the interest rate decrease would lower net capital flow. The income, price, and interest rate effects on the balance of payments thus would work in the same direction to correct the surplus.

The equilibrium adjustment to a deficit is shown graphically in Exhibit 2. The exhibit shows a country with an internal equilibrium at $y_{0}, P_{0}$, and $r_{0}$, but with a balance of payment deficit, with $M-X>F^{n}$ (the ( $M$ $-X, F^{n}$ ) coordinate is below the $45^{\circ}$ line). If the country has sufficient reserves to maintain its exchange rate, then under the Bretton Woods system, the country would intervene in the market to buy its currency with reserves. However, the monetary contraction would push interest rate up, decreasing the level of investments and aggregate demand. This is captured graphically by the leftward shifts in the LM and aggregate demand curves, where at the initial price level there is an excess supply. The aggregate surplus lowers prices (shifting the LM and IS to the right) and real output. As shown in Exhibit 2, the new internal equilibrium occurs at a lower level of real income, $y_{1}$, and price level, $P_{1}$, and a higher interest rate, $r_{1}$. Externally, the changes in $y$, $P$, and $r$ work to correct the balance of payments. In the Mundell-Fleming model, the decrease in real income from $y_{0}$ to $y_{1}$ lowers net import, $\mathrm{M}-\mathrm{X}$ (movement along the MX curve), the price decrease from $P_{0}$ to $P_{1}$ increases exports and lowers imports (upward shift in the MX curve), and the interest rate increase from $r_{0}$ to $r_{1}$ increases net capital flows. The decrease in net imports and the increase in capital flows work to reduce the deficit. The equilibrium adjustment process would continue with the deficit reducing the money supply, the monetary contraction changing $y, P$, and $r$, and the changes in $y, P$, and $r$ lowering the deficit until an external equilibrium is reached where the deficit is zero.

Exhibit 2: Monetary Adjustment to a Deficit under a Fixed-Exchange-Rate System


The equilibrium adjustment to a surplus is shown graphically in Exhibit 3. The exhibit shows a country with an internal equilibrium at $y_{0}, P_{0}$, and $r_{0}$, but with a balance of payment surplus, with $M-X<F^{n}$ (the ( $M$ $-X, F^{n}$ ) coordinate is above the $45^{\circ}$ line). If the country allows its increase in foreign currency to be converted, then its money supply will increase. The resulting monetary expansion pushes interest rate down, increasing the level of investments and aggregate demand. This is captured graphically by rightward shifts in the LM curve and the aggregate demand curve, where at the initial price level there is an excess demand. The aggregate shortage increases prices (shifting the LM and IS to the left) and increases real output. As shown in Exhibit 3, the new internal equilibrium occurs at a higher level of real income, $y_{1}$, and price level, $P_{1}$, and a lower interest rate, $r_{1}$. Externally, the changes in $y, P$, and $r$ work to correct the balance of payments. Specifically, the increase in real income from $y_{0}$ to $y_{1}$ increases net import, $M-X$ (movement along the MX curve), the price increase from $P_{0}$ to $P_{1}$ decreases exports and increases imports (downward shift in the MX curve), and the interest rate decrease from $r_{0}$ to $r_{1}$ decreases net capital flows. The increase in net imports and the decrease in capital flows work to reduce the surplus. The equilibrium adjustment process continues with the surplus increasing the money supply, the monetary expansion changing $y, P$, and $r$, and the changes in $y$, $P$, and $r$ lowering the surplus until an external equilibrium is reached where the balance of payments is zero.

Exhibit 3: Monetary Adjustment to a Surplus under a Fixed-Exchange-Rate System


## Persistent Deficits and Surpluses

In a fixed-exchange-rate system, the equilibrium adjustment works through changing the money supply. Under the fixed system, the cause of persistent imbalances is inconsistent policies or exogenous forces. For example, a surplus country fighting inflation with contractionary monetary or fiscal policies, or with its central bank policy sterilizing its reserves by refusing to convert foreign currency, would find its policies offsetting the normal monetary expansion resulting from the surplus. In the Mundell-Fleming model, the country would have an internal equilibrium (at an intersection of the IS/LM and SS/DD curve) but a balance of payments surplus. On the other hand, a deficit country fighting unemployment with expansionary monetary policy or fiscal policy would find its policies offsetting the normal monetary contraction resulting from the deficit. The country would have an internal equilibrium but a balance of payments deficit.

Under the Bretton Woods system, a deficit country fighting unemployment could maintain this position as long as it had sufficient international reserves. Eventually, though, the country would run out of reserves
and be forced to either allow for the monetary contraction or petition the IMF to allow it to devalue. As noted, this is what happened to the United States and Great Britain in the 1960s; it led to the devaluations in the early 1970s and the eventual collapse of the Bretton Woods system. ${ }^{7}$

Under the current flexible system, a surplus country with a central bank policy of sterilizing its reserves to keep its currency devalued could maintain such a position as long as there is no retaliation. As noted, this has been the case in China, where over the last 20 years the country has maintained large international reserve holdings, a stable but devalued currency, and persistent surpluses. ${ }^{8}$ This, in turn, has led to a de facto fixed-exchange-rate system for China with its trading countries. Just as the Bretton Woods system collapsed because of inconsistent policies, the current system may also be unsustainable if deficit countries retaliate with trade restrictions against what they see as currency manipulation.

## Conclusion

For over forty years, the Mundell-Fleming model has been used to explain how alternative exchange rate systems operate and how the different systems impact the effectiveness of stabilization policies. Scholars, in turn, have used their model to explain the monetary adjustment process to an imbalance under the fixed system, the implications of the loss of monetary policy for countries in the European Monetary Union when faced with economic stagnation, and the 1994-1995 Mexican and 1997-1998 Asian financial crises. In this paper, we examined Mundell-Fleming's fixed-exchange-rate model, highlighting with their model the monetary adjustment process to a balance of payments deficit and surplus, how the Bretton Woods system collapsed, and how surplus countries, like China, use their reserves to maintain stable, but devalued, currencies.

Reflecting on uses of the Mundell and Fleming model, Maurice Obstfeld perhaps captures best their enduring contributions when he says: "a testament to the lasting influence of their work is that much of the current discussion can be framed to what Fleming and especially Mundell accomplished in their work of the 1960s and 1970s....No wonder this body of work has been honored through the award to Mundell of the 1999 Nobel Prize in Economic Sciences" (Obstfeld 2001).

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# Teaching the Concept of Personal Risk Tolerance 

Chris Brune and Scott Miller ${ }^{1}$


#### Abstract

The ability to precisely identify the risk tolerance level of individual investors is a challenge to even the top experts in financial planning. Financial advisors use a variety of tools and methods to carefully measure the propensity of their clients to take risk. This paper provides a template for teaching students the components and challenges of measuring risk tolerance. The purpose is to enhance students' understanding of the factors that affect individual risk tolerance, how these factors can be recognized, and the role risk tolerance must play in asset allocation and portfolio management decisions.


## Introduction

Assessing personal risk tolerance is a key step in the construction of an investment portfolio. An investor must determine the amount of risk he or she is willing to take before selecting an asset allocation and ultimately a portfolio of securities. However, a generally accepted methodology for measuring risk tolerance does not exist. An investor may have a general sense of whether to develop a conservative or aggressive allocation, but quantifying a personal, specific risk tolerance is an imperfect process.

A financial advisor who strives to identify the risk tolerance of a client may address this challenge in a variety of ways. The advisor may use a questionnaire, engage the client in a direct conversation, or rely on experience. A combination of the three commonly occurs in an early meeting with any new client. With an understanding of the client's appetite for risk, the advisor can proceed with an analysis of asset allocation and portfolio management objectives.

However, that process can be difficult to model in a classroom. Building an optimal portfolio is a common component of a traditional undergraduate Investments class, and identifying potential securities to match a designated allocation is achievable utilizing a basic textbook for guidance. But how can the instructor provide a multi-dimensional approach to conducting a risk tolerance assessment? What is the best way to teach a future financial advisor - or any student interested in assessing personal risk tolerance - how to arrive at a proper diagnosis?

This paper provides a template for teaching students to consider personal risk tolerance from multiple angles. The first explores the use of a standardized risk questionnaire much like those that are commonly used in industry; the second incorporates games that lead students to evaluate outcomes of various investment scenarios. Importantly, the games also highlight the role of behavioral biases, which form a third component in our proposed approach to teaching the concept of personal risk tolerance. The objectives are to enhance each student's understanding of the factors that affect individual risk tolerance, how those factors can be recognized, and the role risk tolerance must play in asset allocation and portfolio management decisions.

The remainder of the paper continues as follows. We begin with a literature review, proceed with a discussion of teaching methods and pedagogical benefits, and then conclude with some final comments.

## Literature Review

Conventional economic theory is a natural beginning point for a discussion of personal risk tolerance. As investors rationally seek to maximize their financial well-being, they pursue an investment portfolio that incorporates their propensity for risk. Modern Portfolio Theory (MPT) assists with identifying an optimal mixture of assets, and securities are selected to complete the allocation.

[^13]However, individuals do not always act in ways that maximize household welfare, so it is also important to make a distinction between normative and positive household finance (Campbell, 2006). Surely any number of personal biases and values can influence investment decisions, and attitudes toward risk are embedded in those preferences. Perhaps this is why risk questionnaire items based on loss aversion and selfassessment have been found to be better determinants of a client's true allocation than questions based solely on economic theory (Guillemette et al. 2012).

## Determinants of Risk Tolerance

Multiple factors contribute to an individual's perception of and feelings toward risk. Many studies have evaluated the link to demographic characteristics such as gender and age; others suggest the importance of adding environmental and biopsychosocial variables as well (Grable et al. 2008).

Grable (1997 and 2000) shows a higher risk tolerance for individuals who are male, older, married, more educated, in a professional career, and with a higher income level. Other studies support a difference based on gender (Barber and Odean 2001; Dickason and Ferreira 2018; Bollen and Posavac 2018), although Fisher and Yao (2017) suggest that the gender difference is a function of other determinants (income uncertainty and net worth), rather than gender itself. Similarly, Brooks et al. (2018) show that age affects risk tolerance, but identify other determinants that offer greater explanatory power.

Gustaffson and Omark (2015) agree with Grable (2000) in showing that greater financial literacy also leads to greater risk tolerance. These findings would seem consistent with previous findings that wealthier investors have a higher tolerance for risk (Cohn et al. 1975), and that affluence can mitigate negative financial decisions (Grable et al. 2008).

Gondaliya and Dhinaiya (2016) further explore the role of demographic, socioeconomic, and attitudinal factors. In their study of 500 investors from Gujarat, they note a variety of all three types of personal attributes that significantly influence the results of a risk tolerance questionnaire. Grable and Joo (2004) add biopsychosocial variables and find that self-esteem also plays a role in financial risk tolerance.

External influences on attitudes about risk include current stock market conditions. In their study of the time period surrounding the financial crisis, Guillemette and Finke (2014) show the influence of market events on risk tolerance scores. Gerrans et al. (2015) further explore this relationship and conclude that investors generally maintain a stable tolerance for risk in the short term, but may change their perception of risk over time in response to significant financial events.

## Measuring Risk Tolerance

Regardless of the causes of risk preferences, investor attitudes and values regarding risk must be assessed before they can be integrated into the portfolio construction process. Multiple approaches exist, but the most common method involves a standardized questionnaire used to assign a quantitative score.

Prior research has provided evidence of successful attempts at using questionnaires to assess risk tolerance. Specifically, the use of a questionnaire is supported by the work of Corter and Chen (2006), who introduce and test a Risk Tolerance Questionnaire (RTQ) that proves to be positively correlated with actual investor portfolio risk. Importantly, the RTQ is also correlated to two widely used industry questionnaires, both of which are shown to be effective in measuring investor risk tolerance. Similarly, Grable and Lytton (1999) offer a 13 -item risk assessment instrument, compare it to the Survey of Consumer Finance's (SCF) one-question approach (Grable and Lytton 2001), and empirically test the effectiveness of both (Gilliam et al. 2010). However, in doing so, they also argue for a multi-dimensional process, which is further supported by Snelbecker et al. (1990) and Carr (2014), among others.

Importantly, Carr also proposes a risk-assessment process that extends beyond the use of a questionnaire to identify an investor's risk tolerance. He identifies risk need, risk perception, and future risk tolerance as multiple themes to be considered. Similarly, Cordell (2001) promotes propensity, attitude, capacity, and knowledge as the four components of a RiskPACK framework. The idea that an appropriate understanding of risk requires more than a simple questionnaire is also supported by Adkins (1997), Hanna and Chen (1997), Hanna et al. (2001), and Kitces (2006), all of whom advocate for a blend of subjective and objective measures.

## Teaching Risk Tolerance

Given the difficulty in measuring risk tolerance, and the need for multiple measures, a creative teaching approach is needed to unpack the complexity of the process. The remainder of this paper describes three approaches that can be used to help students better understand the dynamics of assessing personal risk tolerance. First, we ask students to complete a standard risk questionnaire to determine their own objective risk tolerance. Next, we simulate potential payoff scenarios to account for subjectivity. Finally, we ask a series of questions to identify potential behavioral biases.

## Risk Questionnaire

The first method requires students to complete a ten-question diagnostic survey to measure their objective risk tolerance. Answers are entered into an asset allocation software tool to determine the student's mix of asset classes, and an overall risk tolerance (conservative, moderate, or aggressive) is identified. Near the end of the semester, students are presented with a brief report of their proposed allocation. We use Sungard's AllocationMaster ${ }^{\mathrm{TM}}$ software to perform the calculations, but the same process can easily be replicated with a number of free online questionnaires. A list of questions employed is included in Appendix 1.

Interestingly, the risk profile generated from the questionnaire has failed to accurately predict actual student risk taken in a classroom stock trading competition. We run a StockTrak competition throughout the semester, and have yet to find evidence of a relationship between the questionnaire results and portfolio standard deviation, Sharpe ratio, or even the number of trades. Given that questionnaire responses are selfreported, and that no real money is involved, the results may be more of a reflection of the students' selfperception than actual reality.

## Scenario Games

The second approach in teaching risk tolerance is to put the students into real life scenarios where they are forced to make actual decisions that will affect them directly. While most financial planners have to settle for answers to hypothetical questions, few have the opportunity to directly put a client into a situation to test the true response. The students are often quite surprised to see how their self-perception differs from their actual behavior.

This approach consists of five separate "games" that allow students to gain (or lose) course grade points based on their decision to take a "gamble" or a "certainty equivalent" to not play the game. This ensures the students have actual personal value associated with the decisions they make. Based on the value of the certainty equivalent, students classify themselves as Risk Averse (Conservative), Risk Neutral (Moderate) or Risk Seeking (Aggressive). The certainty equivalent is almost always equal to the expected value of the outcome for the gamble. If the students choose to take the gamble, their level of risk tolerance is considered moderate to aggressive. If they choose the certainty equivalent, their level of risk tolerance is considered conservative to moderate. However, most students make different choices given the scenario, even though the tradeoff between the expected value of the game and the certainty equivalent rarely changes. This allows students to analyze any irrational behavioral biases that are exhibited in their decisions.

The first game consists of flipping a coin twice. The payoffs of the game are as follows. If both flips are heads, they lose 10 points. If both flips are tails, they gain 20 points. If the first flip is heads and the second flip is tails, they gain 15 points. If the first flip is tails and the second flip is heads, they lose 5 points. The expected value of this activity would be to gain 5 points. The students are offered five "free" bonus points to not play the game. We use this to act as our certainty equivalent. From a statistical standpoint, to a risk neutral investor, the students should be indifferent to taking the gamble or taking the points at this threshold. Therefore, we assume students taking the gamble in this scenario are more risk tolerant than students who take the certainty equivalent.

The second game is simply rolling a pair of dice. In this scenario, everyone "wins." The students simply receive the total points that are rolled on the dice. They can get as few as 2 points (rolling two "ones") or as high as 12 points (rolling two "sixes"). The expected value of this roll is 7 . We find that several more students take this gamble because they feel they "have nothing to lose" even though the expected value is still equal to the certainty equivalent in this game. We also test students' "illusion of control" bias by giving them the option to have a classmate or the professor roll. The vast majority of students request to have a peer roll the
dice even though they knew this will have no effect on the outcome. Again, we find that students who choose to take the gamble are more risk tolerant than those choosing to take the certainty equivalent.

The third game consists of using a deck of cards. A card is chosen at random by a student. If the card is black (spade or club), they gain the point value of the card. If the card is red (heart or diamond), they lose the point value of that card. A jack is worth 11 , queen is worth 12 , king worth 13 . Students are given the option of allowing the Ace to be worth 1 or 20 points. Since there is an equal probability of either a red or black ace being drawn, the expected value of both choices is zero. However, students overwhelmingly choose to let the ace be 20 . This choice might reflect an overconfidence bias arising from choosing to only focus on the positive 20 points and ignoring the possibility of obtaining negative 20 points. There are an equal number of black and red cards, all of the same value. However, in this instance, the students are given a certainty equivalent of +3 points to not play the game. This implies that any student choosing to take the gamble is actually risk seeking. The odds of the payoff are "against" them, but they might still chose the gamble simply because of the "thrill" or utility they receive from taking risk.

The fourth game combines two of the former games. We roll a pair of dice and then flip a coin. Instead of automatically "winning" the points from the dice roll, a coin is then flipped to determine if the students will "gain" or "lose" the value show on the dice. Again, the expected value of the payoff for this game is zero. Based on the coin flip, students are as likely to gain the points as they are to lose the points. Again, we identify students who take the risk as being risk seeking. Those who choose not to take the gamble, but instead take the 3 point certainty equivalent could be considered to be either risk averse or risk neutral.

The fifth game is a simple flip of the coin. In this game, we attempt to see how risk "averse" some of the students really are. We start with a certainty equivalent of 2 and a payoff of 6 if it is heads and 0 if it is tails. A little over half the class chose the gamble. It has a higher expected value and there is no chance of losing. We then raise the amount of the payoff if the flip is heads. For example, some students choose to take the gamble at 7, more at 8 . Finally, all students choose the gamble with a payoff of 10 as heads versus just 2 as a certainty equivalent. We then choose to change the magnitude. They can receive 20 free points (or $2 \%$ of their final grade) or gamble to receive 100 points ( $10 \%$ of their final grade). Many of the students select the safety of the certainty equivalent fearing they will lose the 20 points of certainty. Although this appears to be more risky, it has the exact same expected value payout. Since this final game is fluid, it really shows the students their true individual levels of biases and tolerance for risk.

## Behavioral Biases

Given the likely inconsistencies between expected and actual risk tolerance for both of the first two approaches, a natural next step is to explore potential explanations. Potential biases are introduced and discussed as shown in Table 1 to prepare students for the next step in understanding the concept of personal risk tolerance.

For our third approach, we ask students to answer survey questions to determine if they have a tendency to act irrationally when confronted with a series of scenarios. Specifically, we use the diagnostic survey developed by Pompian (2006) that helps individuals identify behavioral biases that might arise under various conditions (see Appendix 2). The responses are self-reported and an indication of their perceived actions in each hypothetical scenario instead of measuring the actual action they would take. Each potential bias is tested with three separate questions. Appendix 2 provides a subset sample of the diagnostic questions that we used. Appendix 3 identifies and defines the behavioral biases used in this study and which games would be applicable to each bias. We then also include reflection questions for the students to analyze their own behavior to determine if it is rational or irrational. We measure the "level" of likelihood to exhibit the bias by recording how many questions they answer that imply the bias. For example, a student who exhibits the bias on all three questions is likely to be more susceptible than a student who exhibits it on one or even none of the questions.

## Pedagogical Benefits

At the conclusion of all three approaches, we discuss similarities and differences among the different methods of evaluating risk tolerance. Students reflect on their risk tolerance as given by the asset allocation software (conservative, moderate, or aggressive). They are also given a score (0-3) of how susceptible they are to each of the behavioral biases discussed above based on their responses to the Pompian (2006) survey.

Many students are surprised to see the contrast of survey answers and their actual actions during the games. While the survey may identify their risk tolerance as conservative or moderate, their actions may have showed them to be risk neutral or risk seeking.

Implementation of the approaches in the classroom greatly assists the instructor's ability to keep the students engaged. This method also encourages meaningful discussion that results in students gaining a deeper understanding from observing the experience of their peers. Direct, measurable benefits are achieved by teaching very practical, usable concepts in a manner that personalizes their meaning.

## Conclusion

As a result of completing the Risk Questionnaire, the Scenario Games, and the Bias Analysis, students attain a much greater understanding of assessing personal risk tolerance and the absolute necessity of applying the results to individual asset allocation and portfolio management activities. Exam results and insightful, individualized classroom discussion provide ample evidence of the success of these teaching techniques. Students are not only introduced to the concepts, but also personally benefit from their application. The result is a reinforcement of the concepts presented and retention of the knowledge attained.

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## Appendix 1: Risk Tolerance Questionnaire

For each question, select one of the following answers:
5 - strongly agree; 4 -agree; 3 - indifferent; 2 -disagree; 1 - strongly disagree

1. Expected Return: Given historical returns on different kinds of investments, my desired level of investment return is above average.
2. Risk Tolerance: I am willing to bear an above-average level of investment risk (volatility). I can accept occasional years with negative investment returns.
3. Holding Period: I am willing to maintain investment positions over a reasonably long period of time (generally considered 10 years or more).
4. Liquidity: I do not need to be able to readily convert my investments into cash. Aside from my portfolio, I have adequate liquid net worth to meet major near-term expenses.
5. Ease of Management: I want to be very actively involved in the monitoring and decision-making required to manage my investments.
6. Dependents: There are none or only a few dependents that rely on my income and my investment portfolio support.
7. Income Source: My major source of income is adequate, predictable and steadily growing.
8. Insurance Coverage: I have an adequate degree of insurance coverage.
9. Investment Experience: I have prior investment experience with stocks, bonds and international investments. I understand the concept of investment risk.
10. Debt/Credit: My debt level is low and my credit history is excellent.

## Appendix 2: Behavioral Biases

## Self-Attribution

1. After you make a successful trade, how likely are you to put your profits to work in a quick, subsequent trade, rather than letting the money idle until you're sure you've located another good investment?
a. When I sell a profitable investment, I usually invest the money again right away.
b. I will usually wait until I find something I really like before making a new investment.
c. Some combination of choices A and B.
2. After making an investment, assume that you overhear a news report that has negative implications regarding the potential outcome of the investment you've just executed. How likely are you to then seek information that could confirm that you've made a bad decision?
a. Very likely $\quad$ b. Likely $\quad$ c. Unlikely $\quad$ d. Very unlikely
3. When returns to your portfolio increase, to what do you believe the change in performance is mainly due?
a. Your investment skill. b. A combination of investment skill and luck c. Luck

## Representativeness

1. Jim is an ex-college baseball player. After he graduated from college, Jim became a physical education teacher. Jim has two sons, both of whom are excellent athletes. Which is more likely?
a. Jim coaches a local Little League team.
b. Jim coaches a local Little League team and plays softball with the local softball team.
2. Consider the two sequences of coin-toss results shown ( $\mathrm{H}=$ Heads, $\mathrm{T}=$ Tails). Assume that an unbiased coin has been used. Which of the two sequences do you think are more likely?
a. T-H-H-T-T-H
b. T-T-T-T-H-H
c. Equal likelihood
3. PharmaGrowth is a hot, new IPO. In which category should it most likely be placed? Category A consisting of stocks that have been successful long-term investments or Category B consisting of stocks that have failed as long-term investments?
a. $\mathbf{A}$
b. B

## Overconfidence

1. How easy do you think it was to predict the collapse of the tech stock bubble in March of 2000?
a. Easy b. Somewhat easy c. Somewhat difficultd. Difficult
2. How much control do you believe you have in picking investments that will outperform the market?
a. Absolutely no control
b. Little if any control
c. Some control d. fair amount of control
3. Relative to other drivers on the road, how good of a driver are you?
a. Below average
b. Average
c. Above average

## Framing

1. Suppose you hear of a progressive new cancer drug that is expected to save $25 \%$ of patients treated. The drug costs $\$ 1,000$ a year and may be made available in the next couple of years if it gains support. You come across the drug again in an article that headlines " 75 percent of people will die without the medicine". How likely are you to support the drug given the additional article.
a. More likely
b. Less likely
c. Equally likely
2. Given portfolio A and portfolio B with equal asset allocations and risk/return tradeoffs. Portfolio A has a $75 \%$ chance of meeting your financial goals whereas portfolio B has a 1 in 4 chance of not meeting your goals. Which portfolio do you prefer?
a. $\mathbf{A}$
b. B
c. No preference
3. Imagine that the US is preparing for the outbreak of an unusual disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimates of the consequences of the program are as follows: If program $A$ is adopted, 200 people will be saved. If program B is adopted, there is a one-third probability that 600 people will be saved and a two-thirds probability that no people will be saved. Which of the two programs do you favor?
a. $\mathbf{A}$
b. B
c. No preference

## Appendix 3: Behavioral Biases and Corresponding Games

| Bias | Games | Definition | Student Questions |
| :---: | :---: | :--- | :--- |
| Ambiguity <br> Aversion | 3,4 | Preferring for known risks <br> over unknown risks. | Did you shy away from more <br> complicated games that had more <br> steps to them? |
| Anchoring <br> and <br> Adjustment | $2-5$ | Fixating on a target number <br> or value (i.e. S\&P 2,000 or <br> breaking even on an <br> investment). | If you lost points in the early in the <br> process, did you try to make up for <br> your losses or try to "break even" <br> on subsequent games? |
| Cognitive <br> Dissonance | 4 | Believing two contradictory <br> things at the same time | Did you change your "bet" on <br> game \#4? Why? The expected <br> value of the outcome did not <br> change. |
| Confirmation |  | Searching for information <br> that confirms preexisting <br> beliefs |  |


| Conservatism |  | Revising beliefs too slowly when presented with new evidence |  |
| :---: | :---: | :---: | :---: |
| Endowment | 1, 4 | People ascribe more value to things merely because they own them | One class not only wanted to flip the coin, but they didn't even want to use my coin. They wanted to flip their OWN coin. |
| Framing | 1, 3, 4 | Reacting depending on how it is presented. | Did you choose to avoid games that were more in your favor because you may have lost points? |
| Hindsight | 1-5 | Believing an event was predictable after it occurs "knew it all along" | Did you regret any decisions when they were less than optimal? Or confirm the bets that were optimal? |
| Illusion of Control | 1-4 | Overestimating the ability to control events | Did you want to have someone besides the professor roll the dice? Pick the card? Flip the coin? |
| Loss Aversion | 1, 3, 4 | Preferring to avoid losses | Did you avoid games that could lose points? Why did the participation in game \#2 exceed game \#1? |
| Mental <br> Accounting | 3, 4, 5 | When people put their money into separate categories | Did you take more risk if you won earlier games? Did you feel that you were "playing with winnings" from previous games? |
| Optimism | 3 | Believing there is lesser risk of experiencing a negative event. | Why did you choose to make the Ace worth $\pm 20$ points instead of $\pm 1$ point? |
| Overconfidence | 3 | Believing your judgment is reliably greater than the objective accuracy of those judgments. | Why did you choose to make the Ace worth $\pm 20$ points instead of $\pm 1$ point? |
| Recency | 2, 3, 4 | Emphasize more recent events and ignore the bigger picture | Were you less likely to play \#2 if you lost in \#1? Did your decision to play one game depend on the previous game? |
| Regret Aversion | 1-5 | Avoiding decisive action because of fear the choice will be less optimal (in hindsight) | When raising your hand to participate in the game were you the first hand up? Did more hands affect your decision? Did a +20 point payoff in the first game urge you to gamble in the next games? |
| Representativeness | 1, 2, 4 | Making conclusions about a larger population based on a smaller sample. | Did you play or avoid game \#4 because you were "burned" in games \#1 or \#2? |
| Self <br> Attribution | 1,2,3 | Attributing successful outcomes to skill but blaming unsuccessful outcomes on bad luck. | When rolling the dice in game \#2, why did you switch the person that flipped the coin in \#1? If \#2 was suboptimal, why did you change the person picking the card in \#3? |
| Status Quo |  | Preference for current baseline. Any change is a perceived loss. | What did everyone else in the class do? As more participate, did it change your decision? |


[^0]:    ${ }^{1}$ Maretno A. Harjoto, Professor of Finance, Pepperdine Graziadio Business School, Pepperdine University, 24255 Pacific Coast Highway, Malibu, CA 90263, maretno.harjoto@pepperdine.edu, 310-506-8542; Abraham U. Park, Associate Professor of Finance, Pepperdine Graziadio Business School, Pepperdine University, 24255 Pacific Coast Highway, Malibu, CA 90263, abraham.park@pepperdine.edu, 310-506-8539. Harjoto acknowledges 2015-2017 and 2019-2021 Denney Academic Chair Endowment for financial support and release time for this research. Both authors thank the reviewer and the Editor E.F. Stephenson for their constructive comments and recommendations.

[^1]:    YouTube and Screencast variables are based on the question 4 of Appendix B to control for the delivery methods of asynchronous prelecture videos. Robust t statistics in parentheses with clustered standard errors by each class section. * significant at $10 \%$; ** significant at $5 \%$; *** significant at $1 \%$. See Appendix C for variable descriptions.

[^2]:    ${ }^{1}$ Duncan: University of Kentucky, Department of Economics, 245Q Gatton College of Business and Economics, Lexington, KY; email: dfdunc2@g.uky.edu. Muchiri: Eastern Connecticut State University, Department of Economics and Finance, 453 Webb Hall, Willimantic, CT; email: muchiris@easternct.edu. Paraschiv: State University of New York at Oswego, Department of Economics, 445 Mahar Hall, Oswego, NY 13126; email: mihai.paraschiv@oswego.edu. We thank G. Dirk Mateer, Abdullah AlBahrani, and two anonymous referees for helpful guidance and insight. Any remaining errors are our own.

[^3]:    ${ }^{2}$ http://www.imdb.com/chart/toptv/.
    ${ }^{3} \mathrm{http}: / / \mathrm{www} . h o l l y w o o d r e p o r t e r . c o m / l i s t s / b e s t-t v-s h o w s-e v e r-t o p-819499$.
    ${ }^{4}$ An excellent starting point is the Internet Movie Database, which maintains synopses of each season as well as the entire series. The synopses also include brief descriptions of major as well as minor characters and can be found at https://www.imdb.com/title/tt0903747/plotsummary. A more detailed description of the characters within the series can be accessed at http://breakingbad.wikia.com/wiki/Breaking_Bad_Wiki.
    ${ }^{5}$ Becker (1968) models the choice of engaging in criminal behavior as the interplay between the costs (e.g., probability that an offense is discovered and the size of punishment) and benefits (monetary rewards) of such choice.

[^4]:    ${ }^{6}$ Starting Point is an online resource developed by G. Dirk Mateer, Linda S. Ghent, Tod Porter, and Ray Purdom to facilitate the use of media to enhance teaching and learning in economics (https://serc.carleton.edu/econ/media/index.html).
    ${ }^{7}$ http://www.hollywoodreporter.com/lists/best-tv-shows-ever-top-819499

[^5]:    ${ }^{1}$ Both: Professors of Accounting, Department of Accounting and Information Systems, School of Business, The College of New Jersey. Emails: hnouri@tcnj.edu and Shahid@tenj.edu.

[^6]:    ${ }^{2}$ Unless otherwise stated, for tests of all hypotheses, Goodman and Kruskal tau, and uncertainty coefficients for directional measures, as well as phi, Cramer's V, and contingency coefficients for symmetric measures, were similar to the chi-square test.

[^7]:    ${ }^{3}$ All tests, including the Goodman and Kruskal tau and uncertainty coefficient for directional measures, as well as phi, Cramer's V, and Contingency Coefficient for symmetric measures were similar to chi-square. Therefore, the reported chi-square test is assumed to be appropriate for analysis.

[^8]:    ${ }^{4}$ We used three categories to have meaningful statistical analysis. Using seven categories yielded seven cells with fewer than five observations, which violates the chi-square test assumption.

[^9]:    ${ }^{1}$ Johnson: Professor, Department of Finance, Xavier University, Cincinnati, OH, 45207, Johnsons@ xavier.edu. Sen: Professor, Department of Economics, Xavier University, Cincinnati, OH, 45207, Sen@xavier.edu. We thank an anonymous referee for useful and excellent suggestions.
    ${ }^{2}$ By 1970, U.S. inflation reached $5 \%$ and the U.S. began to run a trade deficit for the first time. Under the Bretton Woods system, European central banks were obliged to buy dollars at a fixed exchange rate, and the U.S. was not constrained by the balance of payments from creating more dollars. As a result, European and Japanese central banks accumulated unwanted dollar foreign

[^10]:    ${ }^{4}$ Note that by assuming foreign parameters are constant, it is not necessary to assume that exports, imports, and capital flows are a function of the differentials in parameters. The development of a more detailed model would require such specifications.

[^11]:    ${ }^{5}$ In addition, the balance of payments is also affected by the secondary effect that changes in the exchange rate have on $y, P$, and $r$. This secondary effect, however, has the opposite effect on $y$ and $P$ that the monetary effect has. For example, in the case of a deficit, the resulting monetary contraction lowers $y$ and $P$, while the resulting higher exchange rate stimulates the economy by increasing real exports and decreasing real imports, leading, in turn, to a larger $y$ and $P$. The combined monetary and secondary internal effects on $y$ and $P$ may therefore be negligible. The two effects do work, however, in the same direction on interest rates: The monetary contraction resulting from a deficit pushes rates up, and the increase in transaction demand resulting from the increase in net real export demand also pushes rates up. If the monetary and secondary internal effects on $y$ and $P$ offset each other, then the equilibrium adjustment process will occur through changes in just the exchange rate and the interest rate.
    ${ }^{6}$ The monetary adjustment is sometimes explained in terms of an arbitrage argument. See Mankiw (2013).

[^12]:    ${ }^{7}$ Similarly, the 1994-95 financial crisis in Mexico also led to a collapse of its pegged exchange rate system. Following a prosperous period which saw increases in foreign investments, higher oil prices, and economic optimism, a decline in oil prices, an increase in credit risk, and a resulting outflow of capital led to a financial crisis in Mexico and other South American countries. Operating under a fixed system with the peso fixed to the USD, the Mexican central bank had to accept pesos and payout dollars. However, this eventually led to a loss of dollar reserves and forced Mexico to devalue.
    ${ }^{8}$ From 1995 to 2001, for example, the yuan was pegged to the USD at 8.25 yuan $/ \$$, precipitating US threats with tariffs. In 2005, China announced a policy of permitting a gradual increase of the yuan relative to a currency basket.

[^13]:    ${ }^{1}$ Brune: Frank D. Hickingbotham School of Business, Ouachita Baptist University, brunec@obu.edu. Miller: John H. Sykes College of Business, University of Tampa, samiller@ut.edu.

