

**PODCASTS IN THE ECONOMICS CURRICULUM: A STUDY IN
IMPLEMENTATION AND EFFECTIVENESS**

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Abstract: Many people have studied and suggested ways of utilizing various media in the classroom setting, but discussion of the use of the podcast to enhance economic education has been more limited. Podcasts are portable, current, and digestible audio clips that can be used to present and reinforce economic concepts. The goal of this paper is to measure the actual, not perceived, effectiveness of podcast use on learning outcomes in the economics curriculum. The measurement of effectiveness on learning outcomes is multi-faceted. Podcasts are a new learning tool in economics that have yet to be tested with regards to actual learning outcomes. This study meticulously controls for demographic characteristics, detailed educational history, learning styles, instructor fixed effects, and class fixed effects while measuring the effectiveness on learning outcomes through podcasts.

Keywords: podcast, experiment, alternative media

JEL code: A2

Instructors are continually seeking new ways to keep their students engaged in the learning process and in recent years there has been a call for teaching economists to move away from “chalk and talk” toward alternative teaching methods and media, (Becker 1997 and Becker and Watts 1995). Additionally, examples based on current events and timely topics are often more engaging to students than more traditional or hypothetical examples. (Ghosh and Rahman 2011). The podcast is a form of media that can deliver timely and relevant content in an alternative format. A podcast is a short audio clip that is portable, easily digestible, and often more appealing to today’s student. While numerous economists have provided insight and advice on the use of media such as movies, songs, television clips and social media in the economics classroom, very little work exists on the use of the podcast in economic instruction. In this paper, we discuss our experience using podcasts in our economics courses along with the results of an experiment designed to measure the impact of podcast use on learning outcomes. Our goal is to help potential podcast users consider the costs and benefits of this technique and to provide advice to economics instructors on the integration of old and new media platforms. We begin with a short review of relevant literature and then we describe how we incorporate podcasts into our classrooms, as well as the design and results of our experiment to test podcast effectiveness.

PREVIOUS LITERATURE

Media use in the classroom has become an increasingly popular topic in the economics education literature. Some authors offer methods for presenting economic concepts through music (Hall et al., 2008; Lawson et al., 2008; McClough and Heinfeldt, 2012; Medcalfe, 2010; Tinari and Khandke, 2000), while others focus on film (Barrow and Westley, 1959; Formaini, 2001; Leet and Houser, 2003; Macy and Terry, 2008; Mateer and Li, 2008; Mateer and Stephenson, 2011) or television shows (Gillis and Hall, 2010; Hall, 2005; Luccasen and Thomas, 2010; Mateer

et al., 2011). All cite increased student interest as a motivating factor for their instructional use. Similarly, podcasts are a current form of media that can be implemented for engagement purposes.

While papers on incorporating music, movies, and shows into the economics classroom abound, less has been done on the use of podcasts. Some instructors incorporate audio recordings of themselves into their curriculum and measure effectiveness (Abdous et al., 2012; Bolliger et al., 2010; Copley, 2007; Fernandez et al., 2009; McKinney et al., 2009; O'Bannon et al., 2011; Spies, 2011), but audio recordings of classroom lectures are not what we categorize as a podcast in this study. The existing literature focuses mostly on students' perceptions of learning effectiveness due to podcasts. Studies have explored this topic at the high school level (Swan and Hofer, 2011), undergraduate level (Clark et al., 2007; Moryl, 2013; Moryl and Jiang, 2013; Sutton-Brady et al., 2009; Taylor and Clark, 2010), and the postgraduate level (Clark et al., 2007; Taylor and Clark, 2010). The outcome variable of interest in these works is based on students' belief in podcast effectiveness rather than actual measured effectiveness. All of these studies find that students believe they are performing better due to the incorporation of podcasts. To the best of the authors' knowledge, no previous studies attempt to measure the impact of podcasts on student learning outcomes.

The best approach to measure the effectiveness of different learning tools is a subject for debate. When measuring the effect of technology on learning outcomes, Heinecke et al. (2001) suggest that evaluation would benefit from the inclusion of both qualitative and quantitative measures. They also recommend that evaluation focus on the observed actions of students and not on their self-reported attitudes. The methods researchers employ when evaluating the effectiveness of specific learning tools are quite varied. Macy and Terry (2008) measures the

effectiveness of film using a detailed grading rubric for essays, but a statistical analysis is not pursued. Past studies also attempt to measure the impact of using music lyrics in the economics curriculum. McClough and Heinfeldt (2012) measures effectiveness using unannounced concept quizzes after the lyric analysis is complete and find a positive impact on student learning. It is likely that the best way to measure the impact on learning outcomes varies with the learning tool under consideration.

Given the auditory nature of the podcast, it is important to consider the extensive literature on learning styles when examining the impact of podcast use on student learning outcomes. Learning styles, sometimes referred to as learning modalities, are categorized as kinesthetic, visual, and auditory (Doyle and Rutherford, 1984). A kinesthetic learner prefers a learning environment where he or she can physically interact with the subject, such as touching the material or working a problem out by hand (Kratzig and Arbuthnott, 2006). A visual learner prefers a learning environment where the student has access to pictorial representation of the subject, such as looking at maps, diagrams, charts, or graphs (Kratzig and Arbuthnott, 2006). An auditory learner prefers a learning environment where the student can hear about the subject, such as listening to a lecture or engaging in a discussion (Kratzig and Arbuthnott, 2006). Numerous studies analyze the impact of matching teaching styles to students' preferred learning styles. Kampwirth and Bates (1980) review twenty-two of these studies and find that only two studies show positive impacts on learning outcomes from learning-style matching. One study goes further to test if students' self-reported learning style preference matches their calculated dominant learning style and find little correlation between the self-reported and the actual learning styles (Kratzig and Arbuthnott, 2006). This last result suggests that studies using only self-reported learning style assessments are potentially subject to error.

EXPERIMENTAL DESIGN

Experiment Overview

The authors conducted an experiment during a recent spring semester at the University of Kentucky to evaluate the effectiveness of podcasts in reinforcing economic concepts and improving learning outcomes in the principles of microeconomics courses. We collected data from students in four sections of principles of microeconomics taught by two instructors. The sample includes 185 students and data were collected using pre-surveys, post-surveys, in-class exams, and the Test of Understanding of College Economics (TUCE).

Podcast Content Delivery and Corresponding Assignments – the Treatment

A podcast is a type of auditory media which can typically be downloaded or streamed to a variety of devices. These devices include, but are not limited to, computers and mobile phones. In essence, they are an audio substitute for print news articles. Many podcasts have their own websites that allow direct streaming or downloading. Oftentimes, the audio files are in mp3 format and can be played on almost any computer, as well as the vast majority of other modern technological devices that students own. Moryl (2014) provides an extensive source for podcasts and sample assignments.

Two of the four sections were treatment classes and, in these sections, students were required to read three news articles and listen to eight podcasts. The news article and podcast content served as the basis for homework assignments whose answers were later discussed in class. The experiment podcasts covered current events in either national or world news. Appendix C includes an annotated list of exam questions referencing the economic content from the news articles and podcasts.

While print news articles and podcasts have their differences, a comparison of the two is still valuable. In the first exam period, every class (treatment and control) received the same print news articles. In the exam periods after this, the control classes only received print news articles and the treatment classes only received podcasts.¹ The podcasts that were selected for use, did not have a written transcript available at the time of the experiment. During the later exam periods, the news articles and podcasts did not always present the same examples causing not just the medium of communication to be different but the information relayed, as well. One concern may be the quality of the examples presented are different, but controlling for quality is subjective and not easily accomplished. Even though print news articles are not perfect substitutes for podcasts, the common inclusion of news articles in the classroom makes them a valid control group. Comparing podcasts to the absence of real world examples would not only be unfair to the group who has to go without, but also unrealistic in the economics profession.

Data Collection

Information about students' understanding of economics was gathered directly from students through the use of the TUCE on two occasions - first on the third day of class and second on the second-to-last day of class. Information about socioeconomic factors, educational preparation, and learning styles was gathered directly from students through the use of two surveys - one on the third day of class and one on the day of the final exam. The survey data controls for factors which independently impact knowledge acquisition in economics, such as math aptitude, learning styles, and economic knowledge background. The learning styles were assessed using the Barsch Learning Style Inventory. Information on SAT scores, ACT scores, high school GPA,

¹ Some podcasts had visual stimulus on the website from which they could be downloaded, while some news articles were accompanied by photos or graphs. As such, the minimal visual components present in both are assumed to have negligible effects on the overall results.

and college major of each consenting student were collected from the Registrar's Office. The in-class exams were scheduled throughout the semester. Information about exam grades and final course grades were gathered at the end of the semester after the final grades were submitted to the Registrar's Office as dictated by Internal Review Board (IRB) approval.

Research Design

Each instructor taught two sections of the same course at similar time periods. One of the two sections for each instructor, chosen randomly, served as the control group. Notice that the demographics of the control group and the treatment group are extremely similar with regards to each characteristic as seen in Table 1 and Table 2 in Appendix A. Using the exhaustive list of control variables gained from such a rich dataset, the treatment and control classes can be compared in order to see that the control classes are valid comparison groups for the treatment classes. Even though students freely choose the classes for which they register, the similar course lecture times (mid-day, ranging from 12:00pm to 3:00pm, Monday, Wednesday, and Friday), the equal lecture lengths (fifty minutes), the same class capacities (N=57), and the comparable student body breakdown yield well-founded treatment and control group comparisons.² The control group received only printed news articles to augment the material presented in class. These articles presented real world examples that reinforced specific economic concepts discussed in class. The treatment groups only received printed news articles to supplement the material covered during the first four lectures. The material covered during the remainder of the course in the treatment classes were supplemented with podcasts, as opposed to printed news articles. While the control groups continued their use of printed news articles throughout the semester, the treatment groups received podcasts presenting different real world examples of the

² An in-depth explanation of each variable can be found in Appendix B.

same economic concepts that were represented in the corresponding control groups' articles. The instructors presented both the news articles and the podcasts to the students in neutral tones and demeanors. Sample assignments are presented in Appendix D. Administering printed news articles for the first three lectures for both the treatment and control groups allows for a more in-depth analysis including in-class exam scores. The full list of exam questions is located in Appendix C.

To incentivize participation, all students were given ten bonus points for completing the TUCE, but only those who signed the consent form and completed the survey became a part of the study. Furthermore, all students actually received the ten bonus points even if they failed to complete the TUCE. The students, however, were not privy to this information. By giving all students the points, overall grades were not affected by participation and the student participation information remained anonymous when the instructors calculated final course grades. Students under the age of eighteen were eligible for bonus points, but were not eligible for participation. Only after the semester ended and final grades were submitted to the Registrar's Office did the instructors gain access to the data that was stripped of any identifying information. It is expected that a student's final TUCE score should be higher than the student's original TUCE score due to the acquisition of economic knowledge throughout the semester. The field experiment examines the exam scores and the exam scores on questions relating to the news articles and podcasts in particular over the course of the semester.

EMPIRICAL MODEL

The analysis includes a difference-in-difference estimation using the time between exams to serve as different time periods. This creates a panel dataset of individual students i in class c over exam periods t . The basic estimation will use the following treatment evaluation model:

$$Y_{i,c,t} = \alpha T_{i,c,t} + \beta V_{i,c} + \gamma W_{i,t} + \delta X_i + \theta Z_{i,c} + \varepsilon_{i,c,t}$$

The student learning outcome variable Y now represents the in-class examination scores for individual i in class c on exam t . The treatment T - the switch from printed news articles to podcasts - goes into effect for the treatment classes ($c=1$) starting for the second exam period ($t=2$) through the third exam period ($t=3$). The final exam period was not included because the final exam was cumulative.³ The class dummy $V=1$ when the class is designated as a treatment class and the dummy variable $W=1$ when the exam period includes podcasts ($t=2$ or $t=3$). The variable X contains demographic characteristics of the individual student i . These include a student's SAT score, ACT score, previous economic education, race, gender, age, learning style, prior podcast usage, and prior printed news article usage. The variable Z is an instructor indicator variable, where $Z=1$ indicates that the individual student i had instructor 1. This variable will capture any differences in teaching styles and techniques utilized by the different instructors. Lastly, an error term ε is included.

Students may recall more information when it is presented in the form of a podcast. An increase in recollection may occur for several reasons. It might be that auditory listeners improve their scores and thereby increase the overall class' performance. Students may find the podcast structure more cohesive. The marginal students who had previously not read the written examples (news articles) may decide to listen to the podcasts. A student might choose the podcasts where the news articles had not been chosen either because of the low cost of effort or

³ A class fixed effect was not included. A robustness check was completed to verify that the class fixed effect was not necessary. This was expected given that the course sections used were held at similar times with a similar class size and population. The types of students who would register for one class in the experiment would likely be the same type to register for any of the classes in the experiment.

because of the higher relevancy to the undergraduate demographic. The low cost of effort is the result of the portability of listening while on the go.

Students could perform worse when supplementing their learning with podcasts. Since podcasts are a relatively new learning tool, students may not be as familiar with the structure. It may take time to learn how best to analyze the medium and study with it. Podcasts allow for hands-free listening, which may encourage more students to listen to them; however, it may, also, allow them to multitask while listening to them causing the students to not utilize their full attention on the podcast. This may, ultimately, cause worse educational outcomes.

A second estimation technique is used to analyze the perceived effectiveness of podcast use and the increase in student engagement. The basic estimation will use the following treatment evaluation model:

$$Y_i = \alpha V_i + \beta X_i + \gamma Z_i + \varepsilon_i$$

In this model, Y no longer represents the student exam scores, but instead represents either the interest in economics of an individual student i after the class is completed or the perceived learning outcome of individual student i . The treatment group indicator V is a dummy variable, where $V=1$ indicates that the individual student i is in a treatment class. The rest of the specification is the same as the previous. This is an ordered probit of a cross-sectional dataset.

EMPIRICAL RESULTS

Using the panel dataset, a policy variable T was created that equals one when podcasts are used during that exam period. For the control groups, the policy variable always equals zero. For the treatment groups, the policy variable equals zero for the first exam period and one for the second and third exam periods. The final exam was cumulative and thus not incorporated into the panel study. Using a difference-in-difference estimation technique, the policy variable yields negative and statistically insignificant change in exam grades on questions covering the relevant economic

concepts. Therefore, on average, holding all else constant, students who supplemented their learning with podcasts had exam scores that were statistically no different than students who supplemented their learning with news articles. Being a regular podcast listener is also a positive, statistically significant predictor of exam scores. Being a transfer student is a negative, statistically significant predictor, as is being a kinesthetic learner; however, the coefficient on kinesthetic is not economically significant. The model was run once with all demographic variables included (Table 2 Column 1), once with a reduced number of demographic variables (Table 2 Column 2) that will serve as our base estimation, and once using a Heckman Two-Step correction (Table 2 Columns 3 and 4), for student attrition from the class and subsequently the experiment. The Heckman Two-Step correction found no selection bias.

Policy interaction terms are included in the base estimation for both race (Table 3 Column 1) and gender (Table 3 Column 2). While there are no statistical differences between the gender in regards to podcasts effect on student learning, there do seem to be effects when comparing races. African American students score 23.923% points lower on exam questions covering relevant content than all other races when podcasts are used instead of news articles.

To determine if our results are being driven by different student learning styles matching with the corresponding mediums, the policy variable was interacted with the visual, auditory, and kinesthetic learning styles in Table 4. The results remain statistically insignificant with the inclusion of the learning style interaction term.

In the post-survey, the students were asked to rank their agreement with the following statement: "This class stimulated my interest in economics." The students' possible answer choices were in the form of a scale from one to five. An answer of one indicated that they "Strongly Disagreed," two indicated that they "Disagreed," three indicated that they were

“Neutral,” four indicated that they “Agreed,” and five indicated that they “Strongly Agreed.” As seen in Table 5, the students’ interest in economics was not significantly correlated with being in the treatment group. The students’ interest in economics before taking the class was positively correlated with having an interest in economics after taking the class, but being female was negatively correlated with having an interest in economics.

As in previous literature, the learning outcome of interest has been students’ perceived educational influence. In the post-survey, students were asked to also rank their agreement with the following statement: “The articles increased my understanding of economic concepts.” The treatment group was asked to rank their agreement with the next statement, as well: “The podcasts increased my understanding of economic concepts.” The ranking system was the same as previously mentioned. In Table 6, it can be seen that the treatment group believed that on average they learned more than the control groups who never received podcasts as a learning tool. If students feel as though they are performing better and are more confident in their abilities, then they may work harder, be more engaged, and continue to educate themselves using podcasts as a learning tool after they have finished the class.

ADVICE FOR INSTRUCTORS WHO WISH TO INCORPORATE PODCASTS

The podcast assignments get the most responses when students have at least two days to listen to the podcasts at their leisure. Also, class discussions are greatly enhanced when the instructor has listened to the podcasts recently and does additional research on the topics. It does not take much time to review the podcasts before lectures and can be completed while performing other menial tasks.

Technological Issues

Since students use a variety of audio software, posting the original website location ensures that each student will be able to open the audio file. Many schools use student servers that only support one software system, so if the student uses a different software system to open the audio file then the direct website link will be preferred. No other technological issues have been presented; this is likely due to the high level of technological literacy of the average student.

CONCLUDING REMARKS

The measurement of effectiveness on learning outcomes is multifaceted. Podcasts are a new learning tool in economics that have yet to be tested with regards to actual learning outcomes. This study meticulously controlled for demographic characteristics, detailed educational history, learning styles, instructor fixed effects, and class fixed effects while measuring the effectiveness on learning outcomes. The experiment shows that while students believe the podcasts are improving their educational outcomes, the students who supplemented their learning with podcasts did statistically no better than students who supplemented with printed news articles.

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APPENDIX A

Table 1

Variable	Male Students		Female Students		Non-Black Students		Black Students	
	Obs	Mean	Obs	Mean	Obs	Mean	Obs	Mean
Exam Experiment Questions	320	69.90625	208	71.86538	485	70.92577	43	67.88372
Treatment Group	336	0.291667	219	0.328767	507	0.307692	48	0.291667
Female	336	0	219	1	507	0.39645	48	0.375
Instructor	336	0.455357	219	0.520548	507	0.485207	48	0.4375
Race								
White	336	0.8125	219	0.821918	507	0.893491	48	0
Black	336	0.089286	219	0.082192	507	0	48	1
Hispanic	336	0.008929	219	0.013699	507	0.011834	48	0
Asian	336	0.035714	219	0.068493	507	0.053254	48	0
Other	336	0.053571	219	0.013699	507	0.04142	48	0
Age	336	20.92857	219	21.57534	507	20.98225	48	23.3125
ACT Score	309	25.47573	198	25.09091	465	25.63871	42	21.85714
High School GPA	315	2.971657	219	3.166068	489	3.108417	45	2.431667
Credit Hours	336	15.00893	219	15.80822	507	15.33136	48	15.25
KY High School	321	0.785047	210	0.671429	483	0.73913	48	0.75
Private High School	336	0.232143	219	0.136986	507	0.195266	48	0.1875
Education								
Some Statistics in High School	336	0.767857	219	0.69863	507	0.751479	48	0.625
Some Calculus in High School	336	0.446429	219	0.424658	507	0.43787	48	0.4375
Pre-TUCE Score (%)	336	29.58036	219	29.61644	507	29.39645	48	31.6875
Job in College	336	0.321429	219	0.479452	507	0.384615	48	0.375
Economics Major	336	0.125	219	0.041096	507	0.08284	48	0.1875
Math Major	336	0.008929	219	0.027397	507	0.017752	48	0
Degree-Seeking Student	336	0.982143	219	1	507	0.988166	48	1
Transfer Student	336	0.196429	219	0.219178	507	0.201183	48	0.25
Retaking Class	336	0.080357	219	0.054795	507	0.059172	48	0.1875
Macroeconomics Class Before Experiment	336	0.053571	219	0.082192	507	0.065089	48	0.0625
ESL (English as a Second Language)	336	0.0625	219	0.054795	507	0.059172	48	0.0625
Regular Podcast Listener	336	0.116071	219	0.041096	507	0.08284	48	0.125
Required Class	336	0.767857	219	0.794521	507	0.775148	48	0.8125
Interest in Economics Before Experiment	336	3.669643	219	3.246575	507	3.461538	48	3.9375
MP3 Ownership	336	0.919643	219	0.808219	507	0.893491	48	0.6875
Father's Education								
High School Graduate and Less	336	0.232143	219	0.191781	507	0.201183	48	0.375
Some College	336	0.178571	219	0.164384	507	0.177515	48	0.125
College Graduate and More	336	0.232143	219	0.287671	507	0.266272	48	0.125
Learning Style Propensity								
Visual	336	69.08482	219	66.99486	507	68.10281	48	69.92188
Auditory	336	57.14286	219	55.99315	507	56.00962	48	63.86719
Kinesthetic	336	58.20313	219	55.69349	507	57.30399	48	56.25

Table 2

VARIABLES	(1) Full	(2) Reduced	(3) examexp	(4) tookexam	(5) mills
policy	-0.796 (5.500)	-0.646 (5.440)	-0.289 (5.310)	-1.727 (1.138)	
pretucepercent	-0.197 (0.171)	-0.183 (0.162)	-0.189 (0.157)	-0.179 (0.142)	
female	2.615 (3.096)	2.511 (3.017)	2.358 (2.925)	10.83** (5.186)	
black	3.183	3.344	2.714	29.18	

	(5.762)	(5.660)	(5.580)	(0)
hispanic	-3.464	-5.621	-5.560	-25.05
	(17.89)	(17.55)	(16.95)	(0)
asian	1.762	4.514	4.916	-68.36
	(14.98)	(14.72)	(14.21)	(0)
otherrace	6.436	7.989	7.644	5.707
	(7.388)	(7.228)	(7.068)	(0)
Age	0.897	1.157	1.315	-0.0851
	(1.189)	(1.165)	(1.134)	(0.498)
actconverted	0.714	0.640	0.654	1.535*
	(0.568)	(0.534)	(0.516)	(0.841)
hsgpa	2.506	3.253	3.134	2.916
	(2.745)	(2.677)	(2.637)	(2.286)
econmajor	-6.888	-7.497	-8.111	19.32
	(5.453)	(5.351)	(5.225)	(0)
treatmentgroup	-3.422	-3.099	-3.584	
	(4.669)	(4.555)	(4.430)	
post	7.034*	7.248**	6.919*	
	(3.722)	(3.686)	(3.567)	
instructor	-9.161***	-8.448***	-8.231***	-10.09*
	(2.884)	(2.754)	(2.725)	(5.646)
transfer	-9.763**	-8.975**	-9.483**	14.70*
	(4.591)	(4.445)	(4.402)	(7.973)
credithours	-0.498	-0.442	-0.363	-0.329
	(0.764)	(0.751)	(0.728)	(0.503)
retake	-6.266	-5.436	-3.656	-15.57*
	(7.003)	(6.695)	(6.646)	(8.410)
Job	-2.703	-2.624	-2.691	-5.844**
	(3.276)	(3.032)	(2.937)	(2.633)
regularpodcastlistener	11.05**	12.05**	11.97**	20.19
	(5.404)	(5.180)	(5.023)	(0)
required	-0.993	0.724	0.679	-2.567
	(3.570)	(3.361)	(3.265)	(2.333)
InterestPre	-0.266	-0.501	-0.375	2.259
	(2.146)	(2.061)	(1.995)	(1.400)
feduchscombined	1.563	1.426	0.987	-2.980
	(4.525)	(3.745)	(3.634)	(2.327)
feducsomecollege	3.034	3.454	3.128	7.956
	(4.253)	(4.062)	(3.936)	(4.973)
feducgrad	6.312	6.578*	5.966*	1.381
	(3.899)	(3.696)	(3.587)	(1.827)
private	0.699	0.667	0.480	9.895
	(3.724)	(3.556)	(3.448)	(6.853)
somecalc	3.869	4.827	4.380	9.971*
	(3.788)	(3.680)	(3.662)	(5.182)
somestats	2.021	1.591	1.427	3.402*

	(2.899)	(2.835)	(2.747)	(1.824)	
macro	9.190	8.487	7.597	27.74	
	(6.036)	(5.797)	(5.652)	(0)	
Esl	-15.58	-10.28	-10.56	75.47	
	(15.54)	(15.13)	(14.61)	(0)	
visual	0.145	0.167	0.169	0.0851	
	(0.122)	(0.116)	(0.113)	(0.0795)	
auditory	0.0790	0.0868	0.0815	0.157*	
	(0.109)	(0.107)	(0.104)	(0.0902)	
kinesthetic	-0.207**	-0.218**	-0.223**	-0.323*	
	(0.101)	(0.100)	(0.0972)	(0.179)	
degreeseeking	-7.780				
	(19.41)				
mathmajor	-16.29				
	(13.16)				
kyhs	1.510				
	(3.523)				
meduchscombined	-0.628				
	(4.968)				
meducsomecollege	-1.646				
	(4.436)				
meducgrad	-0.0561				
	(3.706)				
lambda					-6.003
					(15.46)
Constant	42.93	25.25	22.37	-33.48*	
	(44.31)	(37.53)	(36.65)	(20.32)	
Observations	471	476	487	487	487
Number of idnumber	163	165			

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3

VARIABLES	(1)	(2)
	African Am.-Policy Interaction	Gender-Policy Interaction
policy	1.247	0.157
	(5.469)	(5.983)
pretucepercent	-0.164	-0.187
	(0.161)	(0.163)
age	1.204	1.181
	(1.150)	(1.169)
actconverted	0.538	0.654
	(0.522)	(0.536)
hsgpa	2.932	3.250

	(2.629)	(2.679)
econmajor	-7.094	-7.460
	(5.311)	(5.358)
treatmentgroup	-2.924	-3.134
	(4.485)	(4.561)
post	7.321**	7.244**
	(3.661)	(3.689)
instructor	-8.426***	-8.473***
	(2.707)	(2.758)
transfer	-9.111**	-9.042**
	(4.379)	(4.454)
credithours	-0.270	-0.414
	(0.750)	(0.757)
retake	-8.376	-5.308
	(6.732)	(6.713)
job	-2.892	-2.602
	(2.961)	(3.035)
regularpodcastlistener	10.30**	12.01**
	(5.100)	(5.186)
required	0.0636	0.812
	(3.313)	(3.376)
InterestPre	-0.623	-0.404
	(2.012)	(2.084)
feduchscombined	1.719	1.455
	(3.718)	(3.750)
feducsomecollege	4.118	3.480
	(3.944)	(4.067)
feducgrad	6.803*	6.687*
	(3.622)	(3.715)
private	0.899	0.653
	(3.463)	(3.560)
somecalc	4.778	4.693
	(3.644)	(3.706)
somestats	2.243	1.570
	(2.782)	(2.838)
macro	9.052	8.643
	(5.596)	(5.823)
esl	-7.357	-10.06
	(7.944)	(15.16)
visual	0.161	0.164
	(0.115)	(0.117)
auditory	0.0871	0.0866
	(0.106)	(0.107)
kinesthetic	-0.237**	-0.219**
	(0.0992)	(0.100)
female	1.690	3.102

	(2.997)	(3.528)
black	9.937	3.277
	(6.474)	(5.670)
hispanic		-5.920
		(17.60)
asian		4.558
		(14.74)
otherrace		8.086
		(7.242)
policyfemale		-1.957
		(6.042)
policyblack	-25.17**	
	(10.95)	
Constant	26.94	23.82
	(36.76)	(37.82)
Observations	476	476
Number of idnumber	165	165

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4

VARIABLES	(1) Barsch Learning Styles Inventory
policy	-13.67 (22.86)
policyvisual	0.122 (0.246)
policyauditory	-0.0699 (0.209)
policykinesthetic	0.152 (0.236)
pretucepercent	-0.195 (0.164)
female	2.726 (3.028)
black	3.647 (5.732)
hispanic	-6.185 (17.69)
asian	9.077 (14.45)
otherrace	7.796 (7.279)
age	1.392

	(1.174)
actconverted	0.675
	(0.540)
hsgpa	3.624
	(2.735)
econmajor	-7.580
	(5.402)
treatmentgroup	-3.447
	(4.570)
post	7.307**
	(3.700)
instructor	-8.084***
	(2.790)
transfer	-8.757*
	(4.469)
credithours	-0.344
	(0.755)
retake	-2.130
	(6.339)
job	-2.302
	(3.066)
regularpodcastlistener	11.17**
	(5.241)
required	1.149
	(3.362)
InterestPre	0.0658
	(2.025)
feduchscombined	0.701
	(3.724)
feducsomecollege	2.846
	(4.077)
feducgrad	6.021
	(3.700)
private	0.718
	(3.588)
somecalc	4.447
	(3.686)
somestats	1.471
	(2.846)
esl	-13.95
	(14.98)
visual	0.143
	(0.140)
auditory	0.0953
	(0.132)
kinesthetic	-0.240**

Constant	(0.114) 18.28 (37.30)
Observations	476
Number of idnumber	165

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Table 5

VARIABLES	(1) Interest in Econ.
InterestPost	
finalexam	-0.00163 (0.0109)
treatmentgroup	-0.131 (0.208)
pretucepercent	0.0176 (0.0117)
female	-0.535** (0.213)
african american	0.0979 (0.395)
asian	0.859 (1.008)
otherrace	-0.731 (0.503)
age	0.0111 (0.0849)
actconverted	-0.00535 (0.0391)
hsgpa	0.0670 (0.204)
econmajor	0.140 (0.384)
instructor	0.326* (0.197)
transfer	-0.0103 (0.319)
credithours	0.00399 (0.0538)
retake	-0.0614 (0.485)
job	-0.192

	(0.210)
regularpodcastlistener	0.184
	(0.374)
required	0.105
	(0.238)
InterestPre	0.988***
	(0.158)
feduchscombined	0.431
	(0.267)
feducsomecollege	0.00796
	(0.287)
feducgrad	0.408
	(0.267)
private	-0.00333
	(0.248)
somecalc	0.00163
	(0.269)
somestats	-0.131
	(0.205)
macro	0.527
	(0.400)
esl	-0.376
	(1.017)
visual	0.0105
	(0.00824)
auditory	-0.00261
	(0.00760)
kinesthetic	0.00512
	(0.00711)
cut1	
Constant	2.672
	(2.659)
cut2	
Constant	3.687
	(2.661)
cut3	
Constant	5.013*
	(2.668)
cut4	
Constant	6.917**
	(2.686)

Observations	152
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Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6

VARIABLES	(1) Learned Great Deal
LearnedGreatDeal	
finalexam	0.0263** (0.0113)
treatmentgroup	0.633*** (0.217)
pretucepercent	-0.00134 (0.0125)
female	-0.111 (0.220)
african american	0.278 (0.399)
asian	-1.997 (1.258)
otherrace	0.111 (0.496)
age	0.0770 (0.0872)
actconverted	0.0293 (0.0403)
hsgpa	0.103 (0.211)
econmajor	-0.0229 (0.404)
instructor	-0.261 (0.202)
transfer	0.0127 (0.333)
credithours	-0.0189 (0.0547)
retake	0.804 (0.507)
job	-0.115 (0.217)
regularpodcastlistener	-0.164 (0.382)
required	0.223 (0.240)

InterestPre	0.215 (0.146)
feduchscombined	-0.177 (0.274)
feducsomecollege	0.398 (0.304)
feducgrad	0.568** (0.282)
private	0.00574 (0.256)
somecalc	-0.290 (0.277)
somestats	-0.0397 (0.213)
macro	0.750* (0.439)
esl	1.768 (1.387)
visual	0.0112 (0.00854)
auditory	0.00604 (0.00797)
kinesthetic	-0.00929 (0.00744)
cut1	
Constant	3.614 (2.781)
cut2	
Constant	4.096 (2.775)
cut3	
Constant	5.286* (2.786)
cut4	
Constant	6.714** (2.800)
Observations	141

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

APPENDIX B

actconverted: This is the Composite ACT score from Registrar's Office. If no ACT score is listed, then the combined Math and Reading scores from the SAT are converted into an ACT score using the conversion list sponsored by ACT.

age: This is the self-reported year of birth subtracted from the year 2014.

asian: This is a dummy variable, where 1 means the student self-reported his/her ethnicity as Asian and 0 otherwise.

auditory: This is the Barsch Learning Styles Inventory score for being an auditory learner, normalized to a scale from 0 percent to 100 percent.

black: This is a dummy variable, where 1 means the student self-reported his/her ethnicity as Black and 0 otherwise.

credithours: This is the total number of self-reported semester hours the student was taking at the time of the pre-survey.

degreeseeking: This is a dummy variable, where 1 means the Registrar's Office has the student registered as a degree-seeking student and 0 if he/she is registered as a nondegree-seeking student.

econmajor: This is a dummy variable, where 1 means the Registrar's Office has the student's primary or secondary major recorded as an economics major and 0 otherwise.

exam: This is the exam score (from 0 percent to 100 percent) as reported by the instructor.

feducollege: This is a dummy variable, where 1 means the student self-reported his/her father's highest level of education as a college degree and 0 otherwise.

feducgrad: This is a dummy variable, where 1 means the student self-reported his/her father's highest level of education as a graduate degree and 0 otherwise.

feduchs: This is a dummy variable, where 1 means the student self-reported his/her father's highest level of education as a high school degree and 0 otherwise.

feduclesshs: This is a dummy variable, where 1 means the student self-reported his/her father's highest level of education as less than a high school degree and 0 otherwise.

feducsomecollege: This is a dummy variable, where 1 means the student self-reported his/her father's highest level of education as some college and 0 otherwise.

feducunknown: This is a dummy variable, where 1 means the student self-reported his/her father's highest level of education as unknown and 0 otherwise.

female: This is a dummy variable, where 1 means the student self-reported his/her gender as female and 0 otherwise.

finalexam: This is the final exam score (from 0 percent to 100 percent) that the student received as reported by the instructor.

hsgpa: This is the cumulative high school grade point average as reported by the Registrar's Office (0.0 to 4.0 scale).

instructor: This is a dummy variable, where 1 means the student was enrolled in instructor 1's class as reported by the instructor and 0 otherwise.

InterestPre: This is a scale of the student's interest level in economics at the time of the pre-survey. The student was asked to pick the answer that best represents how he/she feels about the following statement: "I am currently interested in economics." InterestPre=1 indicates the student strongly disagrees, InterestPre=2 indicates the student disagrees, InterestPre=3 indicates the student is neutral, InterestPre=4 indicates the student agrees, and InterestPre=5 indicates the student strongly agrees.

job: This is a dummy variable, where 1 means the student self-reported having a job at the

time of the pre-survey and 0 otherwise.

kinesthetic: This is the Barsch Learning Styles Inventory score for being an kinesthetic learner, normalized to a scale from 0 percent to 100 percent.

macro: This is a dummy variable, where 1 means the student self-reported having taken a macroeconomics course prior and 0 otherwise.

mathmajor: This is a dummy variable, where 1 means the Registrar's Office has the student's primary or secondary major recorded as a mathematics major and 0 otherwise.

meduccollege: This is a dummy variable, where 1 means the student self-reported his/her mother's highest level of education as a college degree and 0 otherwise.

meducgrad: This is a dummy variable, where 1 means the student self-reported his/her mother's highest level of education as a graduate degree and 0 otherwise.

meduchs: This is a dummy variable, where 1 means the student self-reported his/her mother's highest level of education as a high school degree and 0 otherwise.

meduclesshs: This is a dummy variable, where 1 means the student self-reported his/her mother's highest level of education as less than a high school degree and 0 otherwise.

meducsomecollege: This is a dummy variable, where 1 means the student self-reported his/her mother's highest level of education as some college and 0 otherwise.

meducunknown: This is a dummy variable, where 1 means the student self-reported his/her mother's highest level of education as unknown and 0 otherwise.

somemath: This is a dummy variable, where 1 means the student self-reported that he/she had taken some mathematics classes prior and 0 otherwise.

mp3ownership: This is a dummy variable, where 1 means the student self-reported owning an mp3 device at the time of the pre-survey and 0 otherwise.

esl: This is a dummy variable, where 1 means the student self-reported that English was his/her second language and 0 otherwise.

kyhs: This is a dummy variable, where 1 means the student self-reported that he/she did attend high school in Kentucky and 0 otherwise.

otherrace: This is a dummy variable, where 1 means the student self-reported his/her ethnicity as Other and 0 otherwise.

periodNum: This is the exam period number as reported by the instructor.

post: This is the post period, where 1 means the student is in exam period 2 or 3.

regularpodcastlistener: This is a dummy variable, where 1 means the student self-reported listening to podcasts regularly at the time of the pre-survey and 0 otherwise.

posttucepercent: This is the score received on the TUCE quiz taken at the end of the semester (from 0 percent to 100 percent).

pretucepercent: This is the score received on the TUCE quiz taken at the beginning of the semester (from 0 percent to 100 percent).

private: This is a dummy variable, where 1 means the student self-reported attending a private high school and 0 otherwise.

required: This is a dummy variable, where 1 means the student self-reported that the Principles of Microeconomics class was a required class at the time of the pre-survey and 0 otherwise.

retake: This is a dummy variable, where 1 means the student self-reported retaking the class and 0 otherwise.

somecalc: This is a dummy variable, where 1 means the student self-reported that he/she had taken some calculus classes prior and 0 otherwise.

somestats: This is a dummy variable, where 1 means the student self-reported that he/she had taken some statistics classes prior and 0 otherwise.

transfer: This is a dummy variable, where 1 means the student self-reported transferring to the university and 0 otherwise.

treatmentgroup: This is a dummy variable, where 1 means the student was enrolled in a class that received podcasts and news articles to supplement his/her learning as reported by the instructor and 0 otherwise.

visual: This is the Barsch Learning Styles Inventory score for being an visual learner, normalized to a scale from 0 percent to 100 percent.

white: This is a dummy variable, where 1 means the student self-reported his/her ethnicity as white nonhispanic and 0 otherwise.

APPENDIX C

Lecture 1 News Article:

A woman is thinking about buying her groceries online or at a grocery store. If she orders them online, then she has more time to work; however, it costs her more for her groceries for the shipping and service fees. The woman chooses to order her groceries online. What is the woman's opportunity cost for ordering her groceries online?

- A. the time spent online shopping
- B. the money spent on the groceries
- C. the time spent at work
- D. the time spent going to the grocery store

Lecture 2 News Article:

If we operate under the assumption that incentives matter, then why do some individuals choose not to do what the incentive structure encourages them to do?

- A. Some individuals are irrational.
- B. Individuals do not choose purposefully.
- C. Costs and benefits are subjective.
- D. Sunk costs exist.

Lecture 3 News Article:

A country's government is debating whether or not to implement private property rights with regards to whaling. How would the population of whales be expected to change after this implementation of property rights?

- A. The whale population would increase because the private property rights would not be well enforced.
- B. The whale population would increase because the whale owners would have an incentive to preserve for the future.
- C. The whale population would decrease because the private property rights would be well enforced
- D. The whale population would decrease because the whale owners would not have an incentive to preserve for the future.

Lecture 4 News Article and Podcast:

Marijuana has been sold despite its illegality in certain places. How does the black market sale of marijuana improve the efficiency of trading?

- A. Black market sales alleviate the marijuana shortage and increase the market price to the equilibrium price.

B. Black market sales alleviate the marijuana surplus and increase the market price to the equilibrium price.

C. Black market sales alleviate the marijuana shortage and decrease the market price to the equilibrium price.

D. Black market sales alleviate the marijuana surplus and decrease the market price to the equilibrium price.

Lecture 5 News Article and Podcast:

A binding minimum wage has many effects. Under a binding minimum wage, compare the quantity supplied with the quantity demanded.

A. The quantity supplied is equal to the quantity demanded.

B. The quantity supplied is greater than the quantity demanded.

C. The quantity supplied is less than the quantity demanded.

D. The quantity supplied and quantity demanded do not exist.

Lecture 6 News Article and Podcast:

How should a business owner take into account the price elasticity of demand when setting the price of his good?

A. The more *elastic* the demand for a good, the more the business owner can *raise* the price of the good and *increase* his overall revenue.

B. The more *elastic* the demand for a good, the more the business owner can *lower* the price of the good and *decrease* his overall revenue.

C. The more *inelastic* the demand for a good, the more the business owner can *raise* the price of the good and *increase* his overall revenue.

D. The more *inelastic* the demand for a good, the more the business owner can *lower* the price of the good and *increase* his overall revenue.

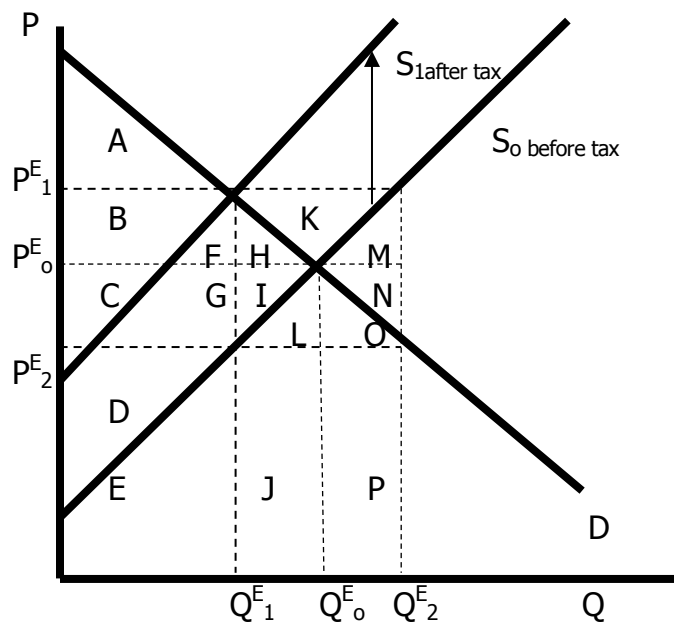
Lecture 7 News Article and Podcast:

What relationship is a public good considered to have in terms of marginal social cost and marginal social benefit?

- A. marginal social cost < marginal social benefit
- B. marginal social cost > marginal social benefit
- C. marginal social cost ignores marginal social benefit
- D. There is no relationship.

Lecture 8 News Article and Podcast:

What area represents the deadweight loss of a tax on the graph below?



- A. A+B+C
- B. A+B+C+D+F+G+H+I
- C. H+I

D. K

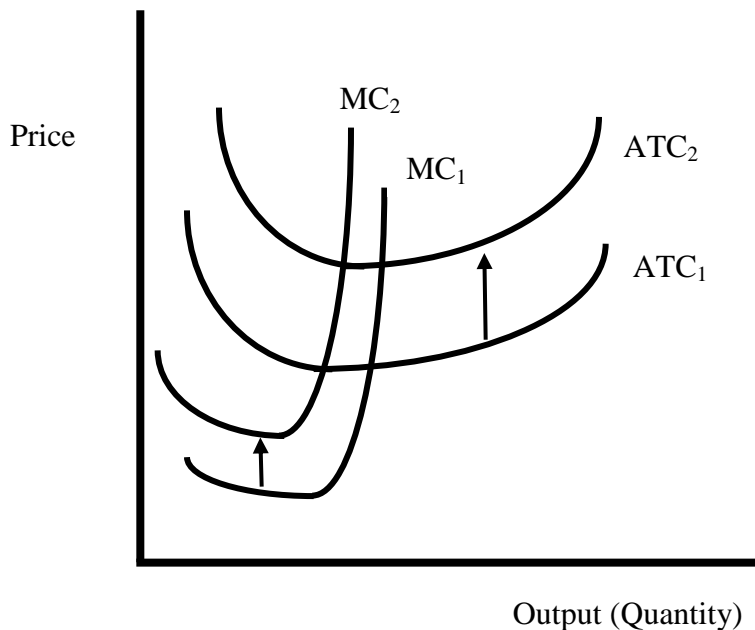
Lecture 9 News Article and Podcast:

What is a possible reason for measuring ‘happiness.’

- A. ‘Happiness’ is an objective measure.
- B. ‘Happiness’ is measured on the same scale for every individual.
- C. ‘Happiness’ is everyone’s first goal in life.
- D. ‘Happiness’ may better represent benefits to an individual.

Lecture 10 News Article and Podcast:

Which reason is most consistent with the shift of the cost curves below?



- A. The price of inputs of production increased.
- B. The tax in the market is lifted.
- C. The required number of quality control tests is lowered.
- D. The technology used in production is improved.

Lecture 11 News Article and Podcast:

How should business owners incorporate their knowledge of the competitiveness of their market when choosing the price of their good or service?

A. If the market is more competitive, then business owners can raise their prices and stay in business.

B. If the market is more competitive, then business owners must set their prices at the market price to stay in business.

C. If the market is less competitive, then business owners can lower their prices and stay in business.

D. If the market is less competitive, then business owners must set their prices at the market price to stay in business.

APPENDIX D

Sample Assignment

The following assignment explores the effects of a binding minimum wage as presented by Puget Sound Business Journal's print news article "A high minimum wage won't always work in workers' favor" by Erin Shannon and National Public Radio's Planet Money podcast "The Riddle of Minimum Wage" by Laura Conway. Questions on the news article assignment included:

1. What are three arguments that the author says are for minimum wage?
2. What are three arguments that the author says are against minimum wage?
3. Assume the current minimum wage is binding. Compare the quantity supplied and quantity demanded of workers in this market.

4. In your opinion, should the United States government increase the federal minimum wage to \$10.00 per hour? Explain.

Questions on the podcast assignment included:

1. What are three arguments that the narrator says are for minimum wage?
2. What are three arguments that the narrator says are against minimum wage?
3. Assume the current minimum wage is binding. Compare the quantity supplied and quantity demanded of workers in this market.
4. In your opinion, should the United States government increase the federal minimum wage to \$10.00 per hour? Explain.

Students received the assignment both as a hard copy in class as well as an electronic copy online. The audio file of the podcast was made available to the students on a course management system. The direct link to the podcast was also distributed in case the posted audio file posed technical issues. The students listened to the podcast, wrote/typed their answers, and returned the completed assignment to the instructor two class periods later. Instructors explained the answers to the class, focusing specifically on similar presentation styles and information.