Willingness to Pay for Online Courses during the Pandemic

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Abstract

During the pandemic in fall 2020, we surveyed students to assess determinants of and willingness to pay for online courses. We found some changes in student perception of online courses as well as the determinants of taking online courses. That is, better grades became less important while convenience of scheduling became more important in student perception as well as in the choice of online courses. In addition to this perceptional factor, degree level, e.g., bachelor's or associate's, became an important determinant to the number of online courses as well as to the amount willing to pay for an online course. We also found that students were willing to pay less than the actual tuition rates for online classes. Our constructed demand analysis indicates that the revenue-maximizing tuition rate should be higher than what students are willing to pay.

Keywords: COVID; online; higher education; demand

Introduction

Distance education has become an increasingly important component of higher education in the U.S. According to the National Center for Education Statistics, the percentage of students at postsecondary institutions who were enrolled in at least one online course increased from 25.5% in 2012 to 36.6% in 2019 (U.S. Department of Education, 2020). This trend of an increasing proportion of online enrollment has occurred at the same time as a decrease in overall postsecondary enrollment. The unduplicated student headcount across all higher education sectors has declined each year from 2012 to 2019, resulting in a total decrease of 10.2% over that time period (National Student Clearinghouse Research Center, 2020). Notably, institutions that primarily offer online instruction have reported an increase in enrollment (EducationData.Org,

n.d.). Given the decline in overall enrollment, the opportunity to attract more students through online learning has become more important to institutions in higher education.

The above trend in enrollment has been complicated by the outbreak of COVID-19. Given this complexity, we investigate a student's perception of online courses as well as a willingness to pay for online instruction during the pandemic to draw some policy implications. In particular, by directly surveying students, we address the following research questions:

1) What factors are important in online course enrollment, and how have these factors changed during the pandemic?
2) How much, on average, is a student willing to pay for an online class over an in-person class, and does the willingness to pay for an online course differ in the groups of students?
3) What does the demand for online classes look like, and what is the implication for tuition revenue and tuition policy?

Literature review

Studies such as Bradbard et al. (2011), Crouse (2015), Farhan (2016), Spradley (2017), and Sá (2019) have found relatively inelastic demand for higher education. Research also suggests that the elasticity of demand may change drastically across different price levels. Curs and Singell (2010) found a greater sensitivity to tuition among students facing higher, out-of-state tuition rates as compared to students paying in-state tuition. The enrollment projections from Bradbard et al. (2011) implied initial elasticities that ranged from -1.01 to -1.26 based on minimal changes from existing tuition rates. However, continuous price increases resulted in projected elasticities ranging from -6.93 to -11.02. Similarly, the quasi-demand curve derived by Langelett et al. (2015) suggested elasticity of demand equal to -0.68 associated with price changes when tuition was less than $9,000 and elasticity of demand equal to -1.44 associated with price changes when tuition was more than $9,000. These results suggest the potential for a "breaking point" at which students' elasticity of demand shifts from relatively inelastic to relatively elastic when tuition increases become too burdensome.

Other variables are also associated with differing elasticities of demand. Brown et al. (2012) determined that price elasticity of demand among freshmen was -1.80. This relatively elastic demand suggested that other institutions were potential substitutes for freshmen. While Hemelt and Marcotte (2011) found that general demand for higher education was relatively inelastic, their results did suggest that the elasticity of demand for the top 120 schools in the United States was greater than the elasticity of demand for other institutions. Farhan (2016) determined that demand was relatively inelastic across universities but particularly so at comprehensive universities. Among community college students, Crouse (2015) computed an elasticity of -0.21, suggesting relatively inelastic demand. While Sá (2019) found that overall demand was relatively inelastic, this research also indicated that demand was elastic among students enrolled in courses associated with lower salaries expected in the future.

There have been relatively few studies that have analyzed the elasticity of demand specifically for online course offerings. Byrd et al. (2015) utilized 2004-2009 data related to public institutions in the United States' Southeastern region. Their estimates suggested elasticity of demand of -4.43 to -4.47 for online courses, in comparison to elasticity of demand of -0.33 to -0.35 for traditional courses. In their analysis based on data from 22 public institutions in the State of

Georgia, Han et al. (2019) found relatively elastic results with measurements ranging from -1.50 to -1.36, suggesting that online courses and traditional courses are substitutes. Spradley (2017) generated different results regarding price elasticity of demand specifically for students aged 25 years or older. Among such nontraditional students, online students were more sensitive to tuition changes than face-to-face students. However, their demand for online courses was still relatively inelastic as indicated by a 1.0% increase in tuition resulting in a 0.9% increase in persistence.

Questions remain regarding the desirability of this movement. Previous research by Vasilevska et al. (2017) indicated that college students have greater demand for face-to-face instruction, possibly as the result of limited experience with online education at lower grade levels. More recently, Alawamleh et al. (2020) found that only 21.8% of students preferred online classes citing lack of motivation, limited understanding of the material, decreased communication between student and instructor, and feelings of isolation as reasons for the preference for face-to-face instruction. Students' beliefs that they learn better in person are supported by research by Dendir (2019). However, institutions may be forced to shift to more online offerings for budgetary reasons even if there are quality issues associated with online sections (Dargaud & Jouneau-Sion, 2020). The budgetary incentives are not clear since increased online instruction is generally correlated with lower tuition levels and the shift to online will not lower costs in the short run (Hemelt & Stange, 2020). A key element of such budget considerations is the enrollment capacities for online courses, but larger online sections may impact the quality of online instruction.

Methodology

To address the research questions listed in the previous section, a questionnaire was designed to collect a variety of information regarding the choice of an online class. Students were asked about their basic demographic information such as age, gender, and marital status, along with some socioeconomic information such as work hours and commuting time. Students were also asked about their perception of the characteristics of online classes, gauging attitudes toward flexibility of online courses, preferred amount of interaction, and content difficulty. Lastly, we asked about a student's willingness to pay for an online course over an in-person class.

The survey was implemented via Qualtrics in October 2020 to undergraduate students pursuing either an associate degree or bachelor's degree enrolled in a public university in the Southeastern U.S. The questionnaire in this study was revised from the one used in a 2018 survey[1] in the College of Business to reflect the changes in higher education forced by the COVID-19 pandemic. The 2020 survey was expanded to include all majors. The survey link was emailed to a random sample of 4000 associate's and bachelor's degree-seeking students across the entire university. The survey was voluntary and a total of 482 students responded to the survey request, for a response rate of 12%. During that semester (Fall 2020), students, with few exceptions, were limited to fully online (100% remote) or hybrid (50% or less delivered in-person with the remainder conducted online) courses as mandated by the state university system. Prior to the pandemic, this university offered the majority of classes in traditional (face-to-face) format; however, the university also had robust offerings in both hybrid and fully online formats, with over 15 years of experience in remote course delivery. Both the university and the system to which it belongs have a significant network of support programs for online instruction. Additionally, the university offered a variety of support services to students in the form of financial grants and

[1] Refer to [authors] (2019) to see the 2018 survey on which the current survey was based.

technology support (loaner laptops and internet connectivity options) to assist students who were not prepared for distance learning in terms of technology. For students who wished to receive instruction on campus, free masks, hand sanitizer, and reduced class enrollments to ensure more personal space between students, were instituted to reduce the risk of contracting the coronavirus. For years the university had been offering free online tutoring services in a variety of disciplines through a contract with SmarThinking.com, but during this semester most other student support services were also offered virtually to assist students in adjusting to the change in the student experience forced by the pandemic.

The profiles of 482 respondents are included in Table 1. Most respondents were in bachelor's programs (88.6%) and roughly half of the respondents were seniors (52.1%) who had taken 90 credit hours or more. As expected, most respondents were single (77.2%). By gender, we had more female respondents (68.5%) than male respondents (29.5%). By discipline, three quarters of respondents were from Arts and Letters (27.8%), Business (24.5%), and Science (21.3%).

Table 1: Profiles of Respondents

(Unit: headcount)

By Credit Hours	0-29 25 (5.2%)	30-59 68 (14.1%)	60-89 138 (28.6%)	90 and more 251 (52.1%)	Total 482 (100%)
By Degree Program	Associate's 55 (11.4%)		Bachelor's 427 (88.6%)		Total 482 (100%)
By Gender	Female 330 (68.5%)	Male 142 (29.5%)	Not answered 10 (2.1%)		Total 482 (100%)
By Marital Status	Single 372 (77.2%)	Married 94 (19.5%)	Other 16 (3.3%)		Total 482 (100%)
By Discipline	Arts & Letters 131 (27.8%)	Science 103 (21.3%)	Business 118 (24.5%)	Education 59 (12.2%)	Total 482 (100%)
	Health 53 (11.0%)	Environment 8 (1.7%)	General 10 (2.1%)		

Perception and Determinants of Online Class

Descriptive characteristics

The average student had taken 5.1 online courses, representing an increase from an average of 0.9 online courses in the 2018 survey. When the number of online courses was collected by subgroups as shown in Table 2, we found that gender and marital status did not make any statistical difference at least in the *median* number of the online courses taken.

Table 2: Average Number of Online Course Taken

			Rank-sum Test	
			on equal distribution	on equal median
Gender:	Female	5.2 (4.0)	*z statistics= 1.433*	*Pearson χ^2=3.649*
	Male	5.1 (5.6)	*Prob.>|z|=0.152*	*Prob.>| χ^2|=0.056*
Marital Status:	Single	4.8 (4.0)	z statistics=-2.300	*Pearson χ^2=1.311*
	Married	6.0 (4.7)	Prob.>|z|=0.021	*Prob.>| χ^2|=0.252*
Degree Program:	Associate's	3.4 (2.7)	z statistics= -3.197	*Pearson χ^2=8.919*
	Bachelor's	5.3 (4.6)	Prob.>|z|=0.001	*Prob.>| χ^2|=0.003*
Discipline:	Arts & Letters	5.7 (5.1)	Arts vs. Science	
	Science	4.3 (3.4)	*z statistics= 2.551*	*Pearson χ^2=3.898*
	Business	6.0 (5.0)	*Prob.>|z|=0.011*	*Prob.>| χ^2|=0.048*
	Education	3.9 (3.2)		
	Health	5.2 (4.9)	Arts vs. Business	
	Environment	3.6 (2.6)	*z statistics= -0.084*	*Pearson χ^2=0.001*
	General	3.9 (3.7)	*Prob.>|z|=0.933*	*Prob.>| χ^2|=0.977*
Credit Hours	0-29	2.1 (1.4)	Freshmen vs. Senior	
	30-59	4.6 (3.9)	*z statistics= -4.691*	*Pearson χ^2=16.356*
	60-89	4.6 (3.7)	*Prob.>|z|=0.001*	*Prob.>| χ^2|=0.000*
	90 and more	5.8 (5.1)		
			Junior vs. Senior	
			z statistics= -2.394	*Pearson χ^2=5.936*
			Prob.>|z|=0.017	*Prob.>| χ^2|=0.015*
Overall	5.1 (4.5)			

( ) standard deviation.

A female respondent had taken 5.2 online courses on average and a male respondent has taken 5.1 online courses on average. The non-parametric rank-sum tests (Wilcoxon, 1945) showed that the null hypotheses of the same distribution and the same median alike were not rejected at the 5% level. For marital status, however, a single respondent had taken 4.8 online courses on average, while a married respondent had taken 6.0 online courses on average. From the rank-sum tests, we inferred that the median values were not statistically different despite the different distributions of their numbers of online courses.

On the contrary, we found that the number of online courses was statistically different in academic disciplines: students in Arts and Letters (5.7 courses) as well as Business (6.0 courses), on average, had taken at least one more online course than students in Science (4.3 courses) and Education (3.9 courses). Rank-sum tests show this statistical difference in distribution and median value. That is, there is no statistical difference in the number of online courses among students in Business and Arts and Letters[2], but a statistical difference does exist between Science and Arts and Letters. We conjecture that lab components might not be fully delivered online as much as students like to experience. For the class years, our data indicated that freshmen (0~29 hours) took only 2.1 online courses while seniors (90 hours and more) took 5.8 online courses. And the rank-sum test confirms this difference although it is quite natural that more time to take online courses students have as they stay at school more.

However, we found that there was a statistically significant difference in the number of online courses between students in associate's degree programs and those in bachelor's degree programs. Respondents in associate's degree programs had taken fewer online courses (3.4 online courses) than those in bachelor's degree programs (5.3 online courses). While this difference would be expected given that bachelor's programs require more coursework than associate's programs, it is relevant to note that the difference in the average number of online classes taken was robust for freshmen and sophomores. For the students under 59 credit hours, students in the associate's degree took 3.3 online courses on average while students in the bachelor's degree took 4.3 online courses on average.

Student perceptions of online classes

We asked students how important various factors were in the choice of an online class over an in-person class using a 5-point Likert scale. There were a total of nine factors selected to capture student perception, four of which were factors in favor of choosing an online course, i.e., better grade, convenience for scheduling, unavailability of a traditional class, and interaction with students, and five of which were factors associated with avoiding an online course, i.e., technical challenges, insufficient interactions with an instructor, expense, concerns about learning, and deadline issues. The survey results are summarized in Table 3.

For the factors that might be positively associated with the choice to take an online course, more than half of respondents ranked two factors, i.e., convenience for scheduling and unavailability of a traditional class, as either 'important' or 'very important.' That is, 72.4% of respondents perceived convenience for scheduling to be very important (55.2%) or important (17.2%) while 60.8% of respondents perceived unavailability of a traditional class to be very important (39.4%) or important (21.4%). On the contrary, many respondents ranked two other factors, i.e., better grades and interactions with students, as 'not at all important' or only 'slightly important.' Of the respondents, 46.1% indicated that better grades were 'not at all important'

[2] Arts and Letters includes Journalism, English, History, Foreign Language, Psychology, Sociology, Political Science, Criminal Justice, Theatre, and Visual Arts.

(27.6%) or only 'slightly important' (18.5%) whereas 74.9% of respondents indicated that interaction with students was 'not at all important' (60.4%) or only 'slightly important' (14.5%).

Table 3: Student Perception on Online Class

(Unit: %)

	Not at all important	Slightly important	Moderately important	Important	Very important	Total
Factors for online class						
Better Grade	27.6 (9.1)	18.5 (12.8)	24.9 (25.6)	15.35 (26.9)	13.69 (25.6)	100.0 (100.0)
Convenience for scheduling	3.5 (4.5)	9.8 (2.1)	14.3 (18.5)	17.2 (37.0)	55.2 (37.9)	100.0 (100.0)
Unavailability of traditional class	8.9 (5.4)	7.9 (8.6)	22.4 (25.1)	21.4 (33.3)	39.4 (27.6)	100.0 (100.0)
Interaction with students	60.4 (66.7)	14.5 (13.6)	11.2 (14.0)	6.2 (2.1)	7.7 (3.7)	100.0 (100.0)
Factors against online class						
Technical challenges	51.7 (43.8)	16.8 (15.3)	15.2 (19.4)	9.8 (12.8)	6.6 (8.7)	100.0 (100.0)
Less Interaction with instructor	15.8 (10.7)	12.9 (12.0)	16.2 (26.0)	18.5 (25.2)	36.7 (26.0)	100.0 (100.0)
Expense	7.9 (12.9)	6.0 (14.5)	15.8 (24.5)	22.4 (20.8)	47.9 (27.4)	100.0 (100.0)
Concerns on learning	20.1 (16.6)	13.9 (12.5)	19.1 (24.9)	16.2 (25.3)	30.7 (20.8)	100.0 (100.0)
Deadline issue	30.5 (25.2)	15.4 (19.4)	18.3 (21.9)	12.2 (19.0)	23.7 (14.5)	100.0 (100.0)

( ) indicates survey results from 2018.

For the factors that might be negatively associated with the choice to take an online course, many respondents ranked the three factors, i.e., expense, less interaction with an instructor, and concerns about learning, as either being 'important' or 'very important'. Specifically, 70.3% of respondents suggested that greater expense was 'important' (22.4%) or 'very important' (47.9%) as a reason not to take an online class. The majority of respondents thought that less interaction with an instructor was 'important' (36.7%) or 'very important' (18.5%) in the preference against online class enrollment. Similarly, 46.9% of respondents ranked concerns about learning as an 'important' (30.7%) or a 'very important' (16.2%) factor against online classes. On the contrary, 68.5% of respondents said that technology associated with an online class was 'not at all important' (51.7%) or only 'slightly important' (16.8%). In contrast to the other factors, student opinion on deadline issues is very diverse: only 23.7% answered that they would not prefer an online class due to the challenges of keeping up with deadlines, while 30.5% said that the deadline issue was not important at all.

Compared with the 2018 survey results, we noted that student perception had significantly changed on the following two factors: better grades and expense. In 2018, 52.5% of respondents said that better grades were an 'important' or 'very important' factor in choosing to take an online class. However, in the 2020 survey, only 29.1% thought that better grades were 'important' or 'very important.' The portion of respondents indicating that grades were 'not at all important' jumped from 9.1% in 2018 to 27.6% in 2020. We conjecture that this shift was due to the pandemic, which made online courses attractive for medical reasons and also eliminated much of the choice between modalities at the time of the survey. Another perception that has changed is expenses. In 2018, 48.2% of respondents ranked the expense of online classes as 'important' or 'very important.' In 2020, this portion jumped to 70.3%. This may be the result of students becoming more sensitive to the tuition rate as the pandemic impacted the economy and their work opportunities.

Factors that influenced online course enrollment

We ran a regression of the number of online courses taken on the socioeconomic factors and perceptional factors; the results are shown in Table 4. When we considered only the socioeconomic factors, we found that three factors, i.e., degree level, willingness to pay, and work hours, were statistically significant in the number of online courses taken by the respondents. Among these three factors, degree level was conspicuous as the result indicated that a student would take roughly two more online courses if their degree level changed from associate's degree to bachelor's degree on the *ceteris paribus* assumption. The impact of degree level on the number of online courses was robust when students' perception of online courses was included in the regression.

On the contrary, willingness to pay and work hours had only a limited impact on the number of online courses taken. That is, a student would take one more online course only when their willingness to pay for an online course increased by $330 or when they became a full-time worker (i.e., worked roughly 37 hours or more). Moreover, the impact of these two factors, willingness to pay and work hours, dissipated when a student's perception of online courses was factored in.

Out of all variables related to students' perceptions, we found that three variables, i.e., concerns about learning, convenience, and deadline issues, were not only statistically significant but also had a substantial impact on the number of online courses taken. That is, the number of online courses would drop by 2.5 if a student recognized that they did not learn well in an online course. This impact was even larger than that of degree level, i.e., 1.8 more courses. Similarly,

the number of online courses would drop by 0.95 if a student felt keeping up with deadlines for online courses was problematic whereas the number would jump by 1.5 if a student found online courses added to scheduling convenience.

Table 4: Estimation Results for the Determinants of the Number of Online Class taken

Dependent variable:	(1)		(2)	
No. of online courses	coefficient	(p-value)	coefficient	(p-value)
Socioeconomic Factors				
Willingness to pay	0.002	(0.079)	**0.003**	**(0.025)**
Age	-0.026	(0.648)	0.014	(0.812)
Gender	-0.340	(0.330)	-0.357	(0.292)
Degree level	**1.834**	**(0.000)**	**2.005**	**(0.000)**
Marital Status	0.623	(0.565)	0.763	(0.442)
Commuting Time	0.001	(0.777)	0.001	(0.802)
Work Hour	0.021	(0.095)	**0.027**	**(0.046)**
Perceptional Factors [a]				
Better Grade	-0.776	(0.120)		
Convenience	**1.498**	**(0.015)**		
Unavailable face-to-face class	0.486	(0.520)		
Technical challenges	-0.421	(0.262)		
Interaction with instructor	0.274	(0.683)		
Burden of expense	0.757	(0.257)		
Concerns on learning	**-2.491**	**(0.000)**		
Deadline issue	**-0.949**	**(0.035)**		
Constant	3.355	(0.028)	1.187	(0.361)
Adjusted R^2	0.146		0.059	

Bold numbers are statistically significant at 5 percent level.
a. Converted to a binary response, i.e., important or not at all important.

Willingness to pay for online courses

Average willingness to pay for an online course

In the survey, we simply asked students how much they would be willing to pay for an online course.[4] The average amount that they were willing to pay was $331.40 for a 3-credit-hour online course as illustrated in Table 5. When this average amount was grouped by degree level, students in associate's programs were willing to pay $282.90 and students in bachelor's programs were willing to pay $337.30. Given the actual tuition for a 3-credit-hour online course of $320.40 for a student enrolled in the associate's program and $559.59 for a student enrolled in the

bachelor's program, students in both programs indicated that they were willing to pay less than their actual tuition rate.

Table 5: Average Amount Willing to Pay for an Online Course

			Rank-sum Test	
			on equal distribution	on equal median
Gender:	Female	$323.7 ($169.7)	*z statistics= -1.911*	*Pearson χ^2=2.714*
	Male	$354.3 ($151.1)	*Prob.>|z|=0.056*	*Prob.>| χ^2|=0.099*
Marital Status:	Single	$320.6 ($152.7)	*z statistics=-4.231*	*Pearson χ^2=11.386*
	Married	$383.8 ($136.4)	Prob.>|z|=0.000	*Prob.>| χ^2|=0.001*
Degree Program:	Associate's	$282.9 ($115.4)	*z statistics= -2.307*	*Pearson χ^2=15.406*
	Bachelor's	$337.3 ($153.5)	*Prob.>|z|=0.021*	*Prob.>| χ^2|=0.000*
Discipline:	Arts & Letters	$321.4 ($153.2)	Between Arts and Science	
	Science	$309.8 ($161.7)	*z statistics= 0.683*	*Pearson χ^2=0.435*
	Business	$351.4 ($142.3)	*Prob.>|z|=0.494*	*Prob.>| χ^2|=0.510*
	Education	$338.9 ($157.3)		
	Health	$331.0 ($135.6)	Between Arts and Business	
	Environment	$381.3 ($148.7)	*z statistics= -1.701*	*Pearson χ^2=2.085*
	General	$373.3 ($110.7)	*Prob.>|z|=0.089*	*Prob.>| χ^2|=0.149*
Credit Hours	0-29	$246.0 ($103.1)	Between Freshmen and Senior	
	30-59	$309.5 ($132.5)	*z statistics= -2.816*	*Pearson χ^2=7.600*
	60-89	$341.9 ($147.0)	*Prob.>|z|=0.005*	*Prob.>| χ^2|=0.006*
	90 and more	$339.8 ($158.1)		
			Between Junior and Senior	
			z statistics= 0.101	*Pearson χ^2=0.009*
			Prob.>|z|=0.919	*Prob.>| χ^2|=0.926*
Overall	$331.4 ($150.6)			

( ) standard deviation.

While both associate's and bachelor's students indicated that they were willing to pay less than the actual tuition rate, the gap between willingness to pay and the actual tuition rate was significantly different among the different groups in these programs. The willingness to pay of a student in the associate's program was only $37.50 less, but the willingness to pay of a student in the bachelor's program was $222.29 less. The rank-sum test shows that students' willingness to pay for an online course was statistically different in degree level in terms of the distribution as well as the median value.

The willingness to pay for an online course was also different based on marital status. A married student was willing to pay $383.80, while a single student was willing to pay $320.60. This difference was statistically significant. Another difference in the willingness to pay exists in the class years as confirmed by the rank-sum tests: freshmen (0-29 hours) were willing to pay $246.0 while juniors and seniors were willing to pay $341.9 and $339.8, respectively. We conjecture that this difference might result from freshmen lacking an understanding of actual tuition costs.

Table 6: Estimation Results for the Determinants of the Willingness to Pay for Online Class

Dependent variable:	(1)		(2)	
Amount to willing to pay	coefficient	(p-value)	coefficient	(p-value)
Socioeconomic Factors				
Age	2.390	(0.113)	**3.717**	**(0.022)**
Gender	10.787	(0.384)	8.886	(0.475)
Degree level	**56.444**	**(0.001)**	**62.002**	**(0.000)**
Marital Status	-4.253	(0.783)	-1.474	(0.925)
Commuting Time	-0.134	(0.192)	**-0.208**	**(0.046)**
Work Hour	0.206	(0.628)	0.438	(0.315)
Perceptional Factors [a]				
Better Grade	-10.710	(0.072)		
Convenience	**17.924**	**(0.011)**		
Unavailable face-to-face class	11.303	(0.052)		
Technical challenges	**-15.026**	**(0.013)**		
Interaction with instructor	3.202	(0.590)		
Burden of expense	**-15.556**	**(0.026)**		
Concerns on learning	-4.782	(0.502)		
Deadline issue	-2.942	(0.611)		
Constant	219.731	(0.000)	177.116	(0.000)
R^2	0.127		0.045	

Bold numbers are statistically significant at 5 percent level.
a. Converted to a binary response, i.e., important or not at all important.

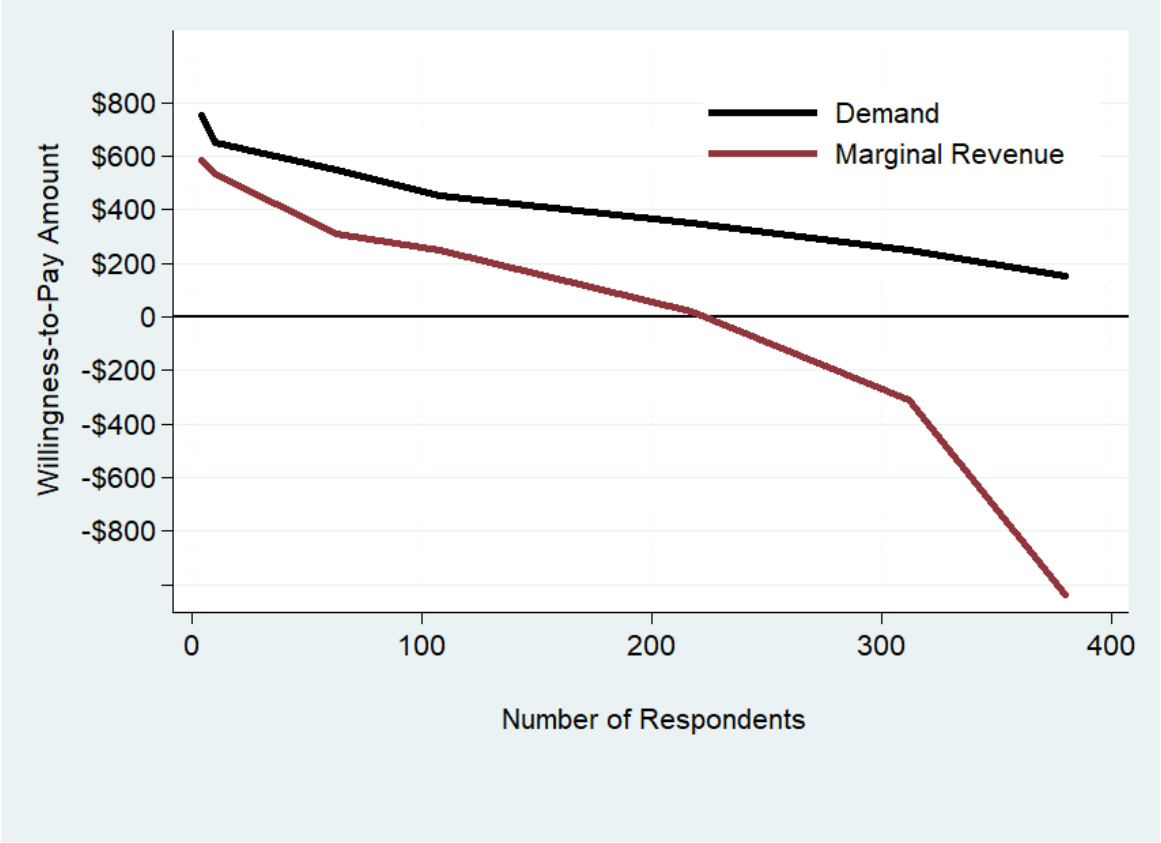
However, gender and academic discipline did not have a statistically significant impact on the willingness to pay for an online course.

Given the differences in the willingness to pay by groups, we regressed the willingness to pay on the potential factors, including socioeconomic and perceptional factors, to find what determines the willingness to pay for an online course. The estimation result is shown in Table 6.

The most important factor impacting a student's willingness to pay was degree level. It was statistically significant that a student would pay $56.40 more (with perceptional factors) or $62.00 more (without perceptional factors) if he or she was enrolled in a bachelor's program as opposed to an associate's program. Age and commuting time were statistically significant factors, but the impact of these variables was very small. Moreover, the significance of age and commuting time disappeared when perceptional factors about online classes were included. Other socioeconomic factors were not statistically significant regarding willingness to pay. Perceptional factors had small but statistically significant impacts on the willingness to pay for an online class.

Demand for an online course and its marginal revenue

Figure 1. Demand Curve and Marginal Revenue for Online Class



Based upon the results from the above section, we constructed the demand curve for an online course and its marginal revenue curve by following Foreit and Foreit (2004)'s manual. The Foreit-Foreit method is a simple means of constructing a demand curve that is consistent with basic economic principles, in particular the law of demand. In it, the cumulative frequency of respondents serves as the quantity while the willingness to pay is regarded as the price. Once a demand curve is

constructed, it is easy to derive its counterpart, a marginal revenue curve. Figure 1 shows the demand curve and the marginal curve for an online course.

By examining the demand curve and the marginal revenue curve, the revenue-maximizing price setting is inferred. Total revenue would be maximized as the marginal revenue becomes 0. At this point, a revenue-maximizing price for an online course is $400, which is more than the average amount that a student is willing to pay for an online course ($331.40).

Willingness to pay: online versus face-to-face courses

In this survey, we asked students to indicate the course modality for which they would be willing to pay more. We used the $50 incremental scale as seen in the questionnaire. Two takeaways were notable from compiling the responses indicated in Table 7.

Table 7: Willingness to Pay for an Online Course over a Face-to-Face Course
(Unit: Headcount)

Willing to Pay more for an Online Course	**77**	**(16.0%)**
- Over $200 more	4	(0.8%)
- $151-$200 more	9	(1.9%)
- $101-$150 more	9	(1.9%)
- $51-$100 more	24	(5.0%)
- Up to $50 more	31	(6.4%)
Same Amount	**231**	**(47.9%)**
Willing to Pay more for an Face-to-Face Course	**174**	**(36.1%)**
- Up to $50 more	48	(10.0%)
- $51-$100 more	53	(11.0%)
- $101-$150 more	34	(7.1%)
- $151-$200 more	21	(4.4%)
- Over $200 more	18	(3.7%)
Total	**482**	**(100.0%)**

The first one is that roughly half of the 482 respondents (47.9%) were willing to pay the same amount for an online course and a face-to-face course. The second takeaway is that 36.1% of respondents were willing to pay more for a face-to-face course and only 16.0% of respondents were willing to pay more for an online course. As expected, fewer students were willing to pay a large amount more for either course modality. Thus, the student responses resemble an asymmetric normal distribution skewed to the face-to-face course.

We then analyzed how the willingness to pay for online courses and face-to-face courses changed during the pandemic by employing ordered Probit and ordered Logit models. Both models

capture how an unobservable variable (y^*), i.e., willingness to pay for an online course over a face-to-face course in our survey, changes when explanatory variables (**x**), e.g., socioeconomic factors and perceptional factors, change. That is,

$$y_i^* = \mathbf{x}_i'\beta + u_i \tag{1}$$

where β is a vector of coefficients, u is normally distributed random errors, and the subscript i denotes an individual respondent. The observed dependent variable (y) changes only when the unobservable variable crosses the thresholds,

$$y_i = j \quad \text{if } \alpha_{j-1} < y_i^* < \alpha_j \tag{2}$$

where j=0 (willingness to pay more for a face-to-face course), 1 (willingness to pay the same for both courses), 2 (willingness to pay more for an online course). Then, the probability that a respondent i selects j, p_{ij}, is

$$p_{ij} = p(\alpha_{j-1} < y_i^* < \alpha_j) = F(\alpha_j - \mathbf{x}_i'\beta) - F(\alpha_{j-1} - \mathbf{x}_i'\beta) \tag{3}$$

The difference between the ordered Probit and the ordered Logit is the cumulative density function, $F(.)$ in (3), where the ordered Probit model uses the standard normal function while the ordered Logit model uses the logistic function.

The estimation result is shown in Table 8. We found that the most important factor in determining the type of course for which a student was willing to pay more was the student's perception regarding the unavailability of a face-to-face class. If a student noted unavailability of a face-to-face class as important, a student was 38.7% (by Probit) ~ 62.4% (by Logit) more likely to choose to pay more for a face-to-face course. We conjecture that a student must have valued face-to-face courses more when they became more scarce.

In addition to unavailability of face-to-face courses, two of the socioeconomic factors had statistically significant impacts on a student's choice. For gender, female students were 19.6% (by Probit) ~ 32.5% (by Logit) more likely to choose to pay for a face-to-face class over an online class. For commuting time, a student who spends one hour commuting to class was 12% (by Probit) ~ 24% (by Logit) more likely to pay for an online class over a face-to-face class.

Given the significance of unavailability of face-to-face courses, we calculate the marginal effects of the factors on the choice of a course format in the willingness to pay;

$$\partial p_{ij} / \partial x_{ki} = \left\{ F'(\alpha_{j-1} - \mathbf{x}_i'\beta) - F'(\alpha_j - \mathbf{x}_i'\beta) \right\} \beta_k \tag{4}$$

where the subscript k denotes three variables, gender, commuting time, and unavailability of a face-to-face class. Table 9 shows the marginal effects. Once a student recognizes the unavailability, the probability of being willing to pay more for a face-to-face would increase by 3.6% (by Logit) to 3.0% (by Probit), and the probability of being willing to pay more for an online course would decrease by 9.3% (by Logit) to 10.3% (by Probit). If this happens, 39.1%~39.7% of students would be willing to pay more for a face-to-face course whereas only 5.7%~6.7% of students would be willing to pay more for an online course. For gender, if more female students are enrolled, for example by 1%, then the probability of being willing to pay more for a face-to-

face course would increase by 2.8% (by Probit) to 3.3% (by Logit) and the probability of being willing to pay more for an online course would decrease by 4.1% (by Logit) to 4.5% (by Probit). On the contrary, a change in commuting time changes the probabilities only by one point percent, thus its impact is small.

Table 8: Estimation Results for the Determinants of the Willingness to Pay in Course Format

Dependent variable:	Ordered Logit		Ordered Probit	
Course format to pay more [a]	coefficient	(p-value)	coefficient	(p-value)
Socioeconomic Factors				
Age	-0.004	(0.853)	-0.001	(0.952)
Gender	**-0.325**	**(0.025)**	**-0.196**	**(0.022)**
Degree level	-0.600	(0.073)	-0.346	(0.060)
Marital Status	0.079	(0.673)	0.030	(0.786)
Commuting Time	**0.004**	**(0.018)**	**0.002**	**(0.018)**
Work Hour	0.007	(0.166)	0.004	(0.192)
Perceptional Factors [b]				
Better Grade	0.353	(0.083)	0.212	(0.080)
Convenience	0.430	(0.309)	0.307	(0.229)
Unavailable face-to-face class	**-0.624**	**(0.046)**	**-0.387**	**(0.033)**
Technical challenges	-0.127	(0.514)	-0.081	(0.474)
Interaction with instructor	-0.510	(0.058)	-0.304	(0.053)
Burden of expense	0.327	(0.409)	0.176	(0.429)
Concerns on learning	-0.463	(0.093)	-0.246	(0.124)
Deadline issue	-0.076	(0.744)	-0.056	(0.680)
Ancillary Parameters				
Constant 1	-1.562		-0.862	
Constant 2	0.834		0.573	
Pseudo R^2	0.044		0.045	
Log Likelihood	-467.00		-466.54	

Bold numbers are statistically significant at 5 percent level.

a. It has 3 categories: 0=willing to pay more for an face-to-face course, 1=same for both courses, 2=willing to pay more for an online course.

b. Converted to a binary response, i.e., important or not at all important.

Table 9: Marginal Effects on the Course Format to Pay More

Factors	Probability of Being willing to pay same for both courses		Probability of Being willing to pay more for an online course	
	(Ordered Logit)	(Ordered Probit)	(Ordered Logit)	(Ordered Probit)
Gender	.033)30)	-0.028 (0.028)	-0.041 (0.028)	-0.045 (0.024)
Commuting Time	000)23)	0.000 (0.023)	0.000 (0.022)	0.000 (0.020)
Unavailable face-to-face class	-0.036 (0.001)	-0.030 (0.001)	-0.093 (0.096)	-0.103 (0.076)

( ) is p-value.

Comparison with the Pre-Pandemic Study

We surveyed undergraduate students to assess what makes students take online courses during the pre-pandemic period (i.e., 2018). Although the scope of the pre-pandemic survey was not identical to the current survey, we did note some changes in student perception of online courses during the pandemic, when all courses were converted to online delivery. That is, under the health risks caused by the coronavirus and the precautionary measures to reduce the risks, student perception changed in a way that a better grade become less important in the choice of online class while convenience in scheduling, as well as a burden of expense, became more important.

Given the change in student perceptions regarding online courses, we found that the determinants of taking online courses have changed. In the pre-pandemic period (i.e., 2018), a better grade was the biggest motivation to take an online course. But as online courses became mainstream with fewer alternatives, better grades became less important to students. Instead, convenience in scheduling provided by the online course became important while concern about learning in online courses deterred students from selecting online classes.

We also noted that some socio-economic factors, i.e., age, marital status, and household income, that become important to the choice of an online course in the pre-pandemic period, were no longer important during the pandemic. Instead, which degree program a student is enrolled in became important. That is, a student in the bachelor's degree program would take more online courses than a student in the associate's degree program.[3]

Despite some changes made in the student perception of online courses and the determinants of taking online courses, there was no significant change in students' willingness to pay for online courses. Despite the slightly different scope of the surveys[4], we did not find any significant changes in the determinants of willingness to pay for an online course. In the 2020 survey, degree level was still the most important factor to determine the amount paid for an online

[3] In fact, on average, students in the bachelor's program take 4.4 online courses while students in the associate's program take 3.3 online courses when we looked at the number of online courses taken only by freshmen and sophomore students.

[4] In 2018, our focus was on how much more a student is willing to pay for an online course over an in-person class. In the 2020 survey, we simply asked how much a student is willing to pay for an online course.

course during the pandemic period as degree level was the most important factor in the 2018 survey to determine the amount *additionally* paid for an online course.

Policy implications and conclusions

Our study showed that there were some changes in student perceptions regarding online courses and the determinants of taking online courses; however, we did not find any significant changes in the determinants of the willingness to pay for the course. These findings imply that it would be advisable for university decision makers to focus on the factors that make students more likely to select online courses. Given that degree level (associate's vs bachelor's) was a significant factor in the number of online classes taken, it would be useful to explore why there is a greater hesitancy for associate-level students to take online classes. At this university, there are higher admission standards for bachelor-level students than associate-level students. It could be that the associate-level students had less confidence in the online format that typically requires students to be more independent learners. If that is the case, universities could provide more resources for online education to provide more "scaffolding" for both students and instructors. For example, universities could hire professional vendors who help instructors videotape their lectures to be comparable to the ones in edX or Coursera as seen in the massive open online courses (MOOCs). Universities could also provide access to third-party programs such as SmarThinking, or Tutor.com to support students who need additional help. They should also continue to improve LMS platforms, e.g., D2L, Blackboard, Canvas, etc. In addition, it may be possible for some institutions to expand enrollment in online courses by encouraging enrollment in bachelor's degree programs as opposed to associate's degree programs or by increasing support specifically to associate-level students who are taking online courses. Given that there were far greater decreases in associate-level enrollments than bachelor-level enrollments during the pandemic (Grawe, 2022; Huie, F. et al., 2021), it is worth exploring what actions can be taken by institutions to rebuild enrollment in this student population, particularly in situations that require a dramatic change in delivery method, like the pandemic.

Our findings also have implications for tuition policies. First, our research finds that approximately half of students surveyed indicated that they were willing to pay the same rate of tuition for both face-to-face and fully online courses, while another third of students said they would pay a lower rate of tuition for online classes. This finding supports the shift in tuition policy made by our university system in 2018. Prior to 2018, the system had been charging a higher tuition rate for online classes. Starting with the 2018-2019 school year, the system revised its policy to charge the same rate for both face-to-face and fully online courses. The revised rate is more in line with student willingness to pay, according to our survey. Given that bachelor-level students had a greater willingness to pay than associate-level students, institutions should price discriminate between the two groups to enhance revenue.

Some colleges and universities may attempt to raise tuition for online classes. The main question for those universities is how much they can raise tuition for an online course. Our findings on the demand and marginal revenue analysis reveal that the tuition rate for an online course could be a bit higher than the average amount that students are willing to pay for an online course. However, the amount by which universities can raise tuition for online classes depends upon a university's ability to enroll its students in bachelor's degree programs (as opposed to associate's degree programs) as well as its effort to change students' perceptions of online classes.

We should point out that our findings are based upon a relatively limited sample, i.e., from a state-funded university in the Southeastern U.S., and thus the findings may vary for different institutions and locations. However, we believe that our research provides a valuable starting point for others to explore students' attitudes and willingness to pay in different situations and circumstances. Surveying attitudes about and willingness to pay for online classes should be done on a regular basis in order to determine how student preferences change over time and thus how limited resources are used for the objectives that an individual school has set. Given that it is critical that institutions of higher education prepare for additional emergency pivots to online course delivery (Oliveira, et al., 2021; Adedoyin & Soykan, 2020), hopefully the results of this exploratory study will add to the research that will inform both policy and planning.

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